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This study explores the effectiveness of using graphic illustrations with written text in promoting learning in social studies by junior high students. Two groups of experimental reading materials, one group composed of three narratives with related graphic illustrations and the other composed of three narratives alone, were prepared and administered to junior high students of comparable socioeconomic backgrounds in two schools. Graphic illustrations used were (1) a time-line with a historical narrative, (2) a product distribution map with a geographic narrative, and (3) a bar graph with an economic narrative. Tests over the materials were administered and results were analyzed using multivariate analysis which considered student IQ scores and reading achievement as well as test scores. Conclusions were both methodological and substantive. It was found that (1) multivariate designs and analyses are superior to other methods in research on school learning, (2) a bar graph with text is superior to text alone in facilitating junior high learning of social studies, and (3) a time-line with text and a product distribution map with text are not superior to text alone. (TT)

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Project No. 2101

Grant No. OE 4-10-071

EFFECTIVENESS OF USING GRAPHIC ILLUSTRATIONS WITH SOCIAL STUDIES TEXTUAL MATERIALS

NOVEMBER 1968

U.S. Department of
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O. L. Davis, Jr.

November 1968

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

Kent State University

Kent, Ohio

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CHAPTER I

INTRODUCTION

Problem

This study sought to explore the effectiveness of using graphic illustrations with written text in promoting pupil learning in the social studies.

The social studies, as do other curricular areas, requires children and youth to deal with many concepts. The nature of the social studies is such that many important concepts must be learned from books and other printed materials. Instruction and learning in this field, therefore, are highly verbal. The principal learning medium is words or other symbols which represent and/or describe ideas, concepts, and information.

Attention has long been given to this highly verbal nature of the field's instructional materials. On the one hand, proposals have been made to decrease the concept load in the social studies, and, on the other hand, suggestions have been made to incorporate many types of illustrations into the textual materials. A major justification for illustrating textual passages with pictures and graphics is, aside from the interest value, the belief that visualizing abstract verbal material will enhance learners' comprehension.

Graphs are one class of pictorial illustrations that are used extensively in social studies instructional materials. They may be seen to perform at least three roles. They may be the principal medium for carrying a specific "primary message" in the communication of author to reader. That is, they may present information not available in an accompanying textual narrative. As illustration, they may serve as organizers, reinforcers, or visualizations of the message presented in the textual narrative. They abstract, in this case, from the narrative and display the major elements of the message in a fundamentally and perhaps a dramatically different form from the same elements in the printed text. They may help the readers organize ideas by their encountering them a second time but in a different form. This latter role is the one which seems to be most favored in school text materials. Also, graphs may be included in text materials simply as decoration. They would have as a primary effect, in this case, the creation of an image, an atmosphere, or a feeling. This use would help pupils and teachers identify materials belonging to history and geography and not, as a ludicrous example, to chemistry or typing.

The ability to use graphic illustrations, to read and interpret them, thus, seems an important factor in learning from printed materials. Concern for the development of pupils' skills in reading and interpreting graphic illustrations has long been manifest by curriculum workers. Researches have been conducted on several problems relating to pupils' ability to use graphs, the relative difficulty of types of graphs, and variables affecting graph comprehension. Yet, both pedagogic and research attention has not differentiated adequately the difference between using a graphic illustration without accompanying text and a graphic illustration with text. The accumulated research evidence about graph utilization, unfortunately, has been extensively concerned with graphs as "primary messages." Accordingly, both the classroom practice and curriculum materials may be the poorer for this persisting neglect.

Do graphic illustrations actually facilitate comprehension of ideas, concepts, and information presented in an accompanying textual passage? If so, for which pupils (at what ability level? at what educational level?) are graphic illustrations most appropriate? These are compelling, but long obscured questions. Failure to answer these questions is to accept related but tangential evidence in lieu of collecting appropriate evidence on which to base theory and to recommend teaching practice.

This project was designed specifically to investigate some of the untested assumptions regarding the use of graphic illustrations with text. Knowledge thus gained on the role of graphic illustrations accompanying a written passage should be of interest not only to authors and publishers of instructional materials in the social studies and other curriculum areas, but also to teachers and other curriculum workers.

Objectives

The major objective of this study was to determine the usefulness of selected graphic illustrations with written text in promoting pupils' learning in the social studies.

The over-all hypotheses tested in this project are listed below:

1. Use of graphs with text does not result in differences in pupils' learning in the social studies when compared with the use of text without graphs in relationship to a) pupils' intellectual ability, b) pupils' educational level, and c) the interactions between these variables.

2. Use of graphs with text does not result in differences in pupils' learning in the social studies when compared with the use of text without graphs, adjusting criterion scores for IQ, in relationship to a) pupils' educational level, b) sex of pupils, and c) the interactions between these variables.

3. Use of graphs with text does not result in differences in pupils' learning in the social studies when compared with the use of text without graphs, adjusting criterion scores for reading achievement scores, in relationship to a) pupils' educational level, b) sex of pupils, and c) the interactions between these variables.

Related Research

Early studies on graph comprehension (7; 12; 32) were concerned primarily with the comparative effectiveness of different forms of presenting data in graphs. The general results, though inconclusive, demonstrated that bar graphs are probably more effective than circle graphs and that other types of graphs are less effective than circle graphs. Recent research evidence seems to support these early conclusions. Peterson and Schramm (21) found that circle graphs are read most accurately of the eight types compared but suggested caution in generalizing from their sample of airmen to general pupil populations. Sarbaugh and his associates (23) reported that bar graphs are probably easier to understand. Wilcox (34), also using adult subjects, reported a bar graph being more effective in fostering comprehension of statistical data in a newspaper than either a table or text.

This research seems partial, likely only tangentially related to the curriculum problem of using printed materials. These studies pitted different types of graphic illustrations against one another or one type of illustration against verbal narrative. These conditions, while intriguing for research and to leisure speculation, almost never occur as pupils study text-type materials.

Studies that have been directed to relevant curriculum-related problems in the effectiveness of graphics have been both too few in number and too restricted in the research questions posed. Most of this research has been directed at questions of the type, "Can pupils interpret (read) certain types of graphics (e.g., maps, bar graphs, table) --- in the absence of text?" Accordingly, after studying children's abilities to comprehend graphic materials, Mathews (19), concluded that development of skill in reading and interpreting graphs, including conventional types of graphs, maps, and time lines, is slow and seldom reaches a high level. Other investigators (16; 17; 18; 24; 25; 26; 33; 35; 36) have also presented evidence that elementary and junior high pupils have difficulty with graphs and maps; their findings are ambiguous with regard to the relative effectiveness of various types of graphs. Specific studies of maps as "illustrations" suggested thirty years ago (13) have not been made. Only Collings (6) seems to have studied children's use of map with text. He found that, in the absence of a specific educational program, junior high pupils do not use maps with text effectively. Recent studies of the development of chronology (1; 14) employed time lines in experimental learning programs but did not investigate the specific role of time lines themselves in learning chronological relationships. While helpful, this evidence still seems most related to graphic illustrations as primary messages.

Grossly neglected, on the other hand, has been the problem of the effectiveness of graphic illustration's with text - really the important pedagogic problem. Perhaps, research attention to this problem has been diverted by failure adequately to understand the differential uses of graphics in curriculum materials and by the belief that sufficient knowledge was available from the research on graphics separately and outside the context of accompanying narrative. The research on the effectiveness of graphic illustrations with text has been scattered and the results are suggestive, but hardly conclusive.

Vernon's pioneer studies (29; 30; 31) demonstrated that a narrative is seldom made easier to comprehend by an accompanying graph. In fact, a graph with text was found to interfere with many readers' understanding of the written text. General conclusions were qualified with three major observations: 1) that graphs accompanying a written text are most useful to rather intelligent and highly educated individuals, 2) that graphs with text must explain the written narrative, and 3) that specific attention is required to build readers' skills to read graphs with text. Vernon's research, while the most productive presently available, seems limited in that it employed only a few types of graphs with text. Two recent studies add to the earlier results. Burdick (5) reported that neither cross-sectional nor cutaway drawings contributes significantly to high school students' comprehension of a written narrative in science. Davis, Hicks, and Bowers (9) concluded that in learning chronological relationships presented in a textual passage, a time-line is most useful for high school students of relatively high intellectual ability.

This evidence, the most relevant to the present problem, is consistent with positions from the more general inquiry into the differential effects of pictorial and verbal stimuli. The research of Broadbent (4), and Travers (27), Gagné (15) and others (2; 3; 10; 11) argues persuasively that human beings process information in single channel modes. Employment of multiple stimulus modes (e.g., auditory-visual; hypothetically, verbal-pictorical) produces interference effects under some conditions. This body of findings indicates clearly that pictorial and verbal stimuli are not equivalent in either their nature or their results. While much serious study is yet to be undertaken (37), enough evidence is available to indicate that the long claimed superiority of picture or illustration over verbal descriptions is largely a slogan and not sound theory.

The accumulated research raises important questions about the usefulness of different types of graphs with accompanying text. The issues are both substantive and methodological. The continued and indiscriminate use of graphic illustrations with text, based upon a priori judgement and generalization from related but irrelevant studies, is quite unjustified. The present study was undertaken to investigate directly some of these important questions and to lay the groundwork for other needed research.

CHAPTER II

METHOD

General Procedures

A large suburban public school system was selected for this project. A suburban system was chosen in order to obtain gross controls over socio-economic status of families, other "community" effects, and varying "school" effects. The junior high grade level was selected because of two principal reasons: no comparable studies had been conducted at this level and a logical place to initiate the long range study of secondary school pupils' use of graphic illustrations with text was the junior high level.

The school system which participated in this project had two junior high schools. Both schools were comparable in size, in quality of personnel and in the composition of their student bodies as judged by experienced administrators in the system. One school, consequently, was selected in which the first group of studies was conducted and the other school provided the subjects and setting for the second group of studies.

For this research project, pupils' IQ and reading achievement scores were obtained from school records. Pupils at each grade level (grades seven, eight, and nine) were assigned to one of two experimental treatments. Subjects were then administered specially prepared experimental materials. The materials used in both treatments included the same narrative; an appropriate graphic illustration accompanied the text in one treatment. The score on a test administered immediately following subjects' completion of the reading of the materials served as the criterion for each experiment.

Two series of studies were conducted. The procedure and findings, from all analyses, are described separately. Series A was the first group of studies and Series B was the second group.

Experimental Materials

Special textual passages were written for this project. One was an historical narrative, another was a narrative describing geographic features and relationships, and the third narrative described economic conditions and relationships. Topics about India were selected for the narratives in order that subjects would be confronted with relatively unfamiliar material.

Historical Narrative

An 1150-word narrative, "India's Road to Independence," focused on one dimension of India's history. The readability of this narrative, based on the Dale-Chall (8) formula, was judged to be at the high 8th - low 9th grade level. For Treatment A, this narrative was not accompanied by a time-line. (See Appendix A.) For Treatment B, this narrative was accompanied by a time-line which incorporated seven events. (See Appendix ~~B.~~b) All events and dates on the time-line were also present in the narrative.

Geographic Narrative

"The Climate of India" was a 1050-word narrative about one aspect of India's geography. Its readability, calculated according to the Dale-Chall (8) formula, was judged to be at the high 7th - low 8th grade level. This narrative was the experimental material for Treatment A. (See Appendix B) A black-and-white product-distribution type map entitled "Annual Rainfall in India," accompanied the narrative in Treatment B. (See Appendix 5) Six rainfall areas were depicted on the map. All cities, rivers, mountains, and water bodies identified on the map were present in the narrative.

Economic Narrative

One dimension of India's economy was described in a 925-word narrative entitled "Farm Production in India." This narrative had a judged readability, based on the Dale-Chall (8) formula, to be at the high 8th - low 9th grade level. For Treatment A, this narrative was not accompanied by a bar graph. (See Appendix 9) For Treatment B, this narrative was accompanied by a bar graph. (See Appendix F.) The graph was entitled "Major Indian Farm Production" and graphically displayed data about five farm products, all of which were treated in the narrative.

Instruments of Measurement

Measure of Intelligence

The measure of intelligence utilized was the California Test of Mental Maturity, Junior High Level, 1957 edition. Scores obtained from this measure had been recorded on pupils' cumulative records. These IQ scores were copied from the cumulative records for purposes of this project.

Measure of Reading Achievement

The score for Reading Achievement was one obtained from the Stanford Achievement Test: Advanced Reading Test, Form X. The entire achievement battery was administered routinely to all seventh and eighth grade pupils each Spring as a part of the school system's guidance program. The Reading Achievement scores were copied from pupils' cumulative records. These scores were available only for the Series A studies.

Criterion Measures

Three tests, one for each set of experimental materials, were constructed for this project. Each test was designed specifically to test the learning of relationships and information incorporated in the textual narrative. Each test had acceptable content validity as judged by three specialists in social studies education.

To test for chronological relationships in the historical narrative, a 14-item multiple-choice instrument was constructed. Its reliability was calculated to be .95. (See Appendix G for a copy of this test.)

A 16-item multiple choice instrument was constructed to test for the relationships in the geographical narrative. The reliability of this test was calculated to be .93. (See Appendix H for a copy of this test.)

To test for relationships in the economic narrative, a 15-item multiple choice instrument was developed. The reliability of this test was calculated to be .94. (See Appendix I for a copy of this test.)

Scores on the criterion tests were transformed into standard scores by the following procedure. A z-score was obtained corresponding to the cumulative proportion of subjects obtaining scores at each raw score level. This z-score was multiplied by 100 and added to 300, thereby eleminating both decimals and negative numbers. The resultant standard scores were employed in the analyses.

Series A Studies

Three experiments were conducted in the Series A studies. Each experiment focused on the usefulness of a specific and relevant graphic illustration (time-line, map, or bar graph) accompanying a textual narrative. In each experiment, the same pupils (Ss) were utilized. The data thus obtained in each experiment were subjected to three analyses.

Subjects

All pupils enrolled in the three grades (seventh, eighth, and ninth) of one junior high school of a suburban public school system served as subjects in this series of experiments. Because of absences and other reasons, complete data were unavailable on a number of these pupils. The 538 Ss for whom complete data (three criterion test scores, IQ score, and, for the 7th and 8th graders, a reading achievement score) were available constituted the population of Ss whose scores were analyzed. Generalizations from the completed analyses should be limited to a hypothetical super-population from which this experimental group might constitute an appropriate sample. This restriction on generalization, while it must be entered, is not at all unlike that which must accompany most if not all educational research; consequently, its practical effect is to urge caution without denying the probable generalizability of the findings to other young adolescents like those in this study.

Administration of Experiments

Ss participated in the three experiments during three regular school days. Each experiment was conducted on a separate day. One week intervened between each experiment. A common procedure was used in the administration of the experiments.

Multilithed booklets containing the prepared experimental materials were distributed randomly to Ss in large study hall sections. The cover of each booklet was identical except for a number which, unknown to the Ss, indicated the experimental treatment in which they were included. A copy of the criterion test was the final part of the booklet.

Ss were instructed to read and study the narrative. After 15 minutes of study time, they detached the narrative from the accompanying test and turned the narrative face down on their desks. Proctors collected this portion of the booklet. Fifteen minutes were allotted to answering the test questions. When test papers were collected, regular study hall routine was resumed. Times for reading and studying the narrative and for taking the test were ample. Most Ss completed the tasks before the end of the allotted period.

Analyses

The first analysis, studies designated A.-.1, tested Hypothesis 1. For this analysis, Ss were grouped into one of three IQ levels. Group I included Ss whose IQ was 120 or above; group II included those with an IQ between 110-119; group III included Ss whose IQ was 109 or below. The experimental design employed was a 2(treatments) X 3(grade levels) X 3(IQ levels) analysis of variance (method of unweighted means).

The second set of analyses, designated A.-.2, tested Hypothesis 2. Analysis of covariance was employed to adjust criterion test scores for IQ scores in a 2(treatments) X 3(grade levels) X 2(sexes) classifacatory scheme. The third data treatment, designated A.-.3, tested Hypothesis 3. Analysis of covariance utilized reading achievement scores as covariants on criterion test scores and employed a 2(treatments) X 2(grade levels: 7th and 8th) X 2(sexes) classification scheme. The analysis of covariance procedure was based on an approximation (28) to take into account unequal and disproportionate Ns in the subclasses.

Series B Studies

This series was designed as partial replications of the Series A.-.1 studies. This second series was conducted approximately one year following the first series, in the same public school system, but in a different junior high school and, consequently, employing different pupils as subjects. The same experimental materials and criterion tests were used in both series. Methodological differences between the two series were a) different IQ classifications and b) different administrations of the experiments.

Subjects

All pupils enrolled in the three grades (seventh, eighth, and ninth) of one junior high school of a suburban public school system served as subjects. Because of absences during the experiments and/or no IQ score in the cumulative records, complete data were unavailable on only a few pupils. The experimental population for this series numbered 1,177. Cautions about generalizations similar to those indicated for the Series A studies (above) are advanced here.

Administration of Experiments

Ss participated in the experiments during their regular social studies class. Classes, undifferentiated by academic ability, were assigned at random to experimental treatments. Each experiment was conducted on a separate day, one week apart. A common procedure was used in administration of the experiments. Prior to the experimental period, the project director met for an orientation session with all social studies teachers. The general purpose of the project was explained and specific instructions were given about administration of the materials.

On the designated days, each teacher distributed the experimental narrative to pupils in his class. The teacher read the instructions aloud and then allowed 15 minutes study time. At the conclusion of study, these booklets were collected and the criterion test was distributed. Fifteen minutes were allotted to answering the test questions. After test papers were collected, regular classwork resumed. At the conclusion of each experiment, teachers permitted pupils to talk about that aspect of India about which they had studied and particularly to raise questions about any of the reading they had done. This procedure was thought by the teachers to approximate classroom reality and "normal-ness" of classroom procedure with some special materials.

Analyses

For the one analysis in this series, testing Hypothesis 1, Ss were further grouped into one of three IQ levels. On the basis of the entire N (1177), approximately one-third of the Ss was determined to possess IQs of 117 or above, one-third to have IQs ranging from 106 to 116, and one-third to have IQs of 105 or below. Consequently, group I included Ss whose IQ was 117 or above; group II included those with an IQ between 106 and 116; and group III included Ss whose IQ was 105 or below.

The experimental design common to all three experiments in this Series was a 2 X 3 X 3 (treatments X grade levels X IQ levels) analysis of variance design. Computations were completed through the use of the CDC 6600 computer at the University of Texas at Austin and the program ANOVAR 23 (EDSTAT-V).

CHAPTER III

RESULTS

In this chapter, results obtained in the two series of studies are presented separately. Each analysis is identified by a code and by a verbal description. The code has three elements. The first element is either the letter A or B which relates to the series in which the data were collected. The next element, a numeral, identifies the experimental materials: *1* identifies the historical narrative materials; *2*, the geographical narrative materials; and *3*, the economic narrative materials. The final element, again a numeral, refers to the type of analysis: *1* relates to the 2X3X3 analysis of variance; *2* designates the 2X3X2 analysis of covariance of criterion scores adjusting for IQ; and *3* identifies the 2X2X2 analysis of covariance of criterion scores adjusting for reading achievement scores.

Results of Series A Studies

Analysis A.1.1: Usefulness of Time-Line with Historical Text

Means and SDs of Ss' scores on the historical narrative criterion test are presented in Table 1. The summary of the analysis of variance of these scores is displayed as Table 2. No significant difference was obtained between treatments, the major interest of the experiment. A series of Scheffé tests revealed that pupils at higher grade levels demonstrated, as might be expected, significantly greater achievement than those at lower levels (grade 9 > grade 8 > grade 7) and, too, that pupils with higher IQ's achieved higher scores than those with lower scores (group I > group II > group III). The significant triple interaction may be explained by the observation that pupils at higher grade levels and lower IQ levels in one treatment scored lower than pupils at lower grade levels and higher IQ levels in the other treatment.

Analysis A.2.1: Usefulness of a Map with Geographic Text

Means and SDs of Ss' scores on the geographical narrative criterion test are presented in Table 3. The summary of the analysis of variance of these data is displayed as Table 4. There was a significant difference between treatments, the major interest of the experiment. Ss in Treatment B (map with text) scored higher on the criterion test than did Ss in Treatment A (text alone). A series of Scheffé tests revealed, as might be

Table 1

Means and Standard Deviations of Historical
Narrative Criterion Scores (Analysis A.1.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	26	353.65	74.29	18	377.94	105.50	13	434.00	54.79
	Group II	19	327.68	84.84	20	329.55	83.63	23	344.65	104.48
	Group III	58	259.26	87.00	54	290.35	75.76	43	304.95	88.28
B	Group I	24	359.08	93.38	13	375.46	82.53	20	452.10	106.36
	Group II	25	312.80	73.65	19	328.47	103.69	28	353.21	67.14
	Group III	47	268.32	84.38	45	291.76	63.30	43	318.86	94.34

Table 2

Summary of Analysis of Variance of Historical Narrative Criterion Scores (Analysis A.1.1)

Source	df	Sum of Squares	Mean Square	F
Treatments	1	80.27	80.27	<1
IQ Levels	2	32134.44	16067.22	26.89**
Grade Levels	2	9195.73	4597.86	7.70**
Treatments X IQ Levels	2	101.67	50.84	<1
Treatments X Grade Levels	2	194.72	97.36	<1
IQ Levels X Grade Levels	4	2214.66	553.67	<1
Treatments X IQ Levels X Grade Levels	4	41504.76	10376.19	17.37**
Within (adj.)	520		597.47	

** Significant at .01 level

Table 3

Means and Standard Deviations of Geographical
Narrative Criterion Scores (Analysis A.2.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	22	327.77	102.46	15	422.47	147.83	16	368.81	81.93
	Group II	25	320.12	71.50	21	331.10	87.50	28	321.68	82.27
	Group III	61	275.67	94.82	55	301.75	86.53	44	321.95	87.34
B	Group I	28	427.36	163.25	16	379.13	109.66	17	430.12	101.77
	Group II	19	317.32	107.31	18	347.33	78.04	23	381.48	127.01
	Group III	44	266.43	88.42	44	302.32	75.13	42	328.48	87.82

Table 4

Summary of Analysis of Variance of
Geographical Narrative Criterion Scores (Analysis A.2.1)

Source	df	Sum Squares	Mean Square	F
Treatments	1	1579.89	1579.89	3.87*
IQ Levels	2	28442.19	14221.09	34.85**
Grade Levels	2	4365.50	2182.75	5.35**
Treatments X IQ Levels	2	904.75	452.38	1.11
Treatment X Grade Levels	2	2766.45	1383.22	3.39
IQ Levels X Grade Levels	4	865.84	216.46	<1
Treatment X IQ Levels X Grade Levels	4	39934.19	9983.55	24.46**
Within (adj.)	520		408.10	

* Significant at .05 level
**Significant at .01 level

expected, that pupils at higher IQ levels demonstrated higher achievement than those at lower levels (group I > group II > group III) and that pupils at higher grade levels manifested higher scores than those at lower grade levels (grade 9 > grade 8 > grade 7). The significant Treatment X Grade Level interaction was further examined and revealed that eighth graders in Treatment A achieved higher scores than ninth graders using the same materials (text alone) and seventh and eighth graders in Treatment B (map with text). The significant triple interaction may be explained by the observation that pupils at higher grade levels and lower IQ levels in one treatment scored lower than pupils at lower grade levels and higher IQ levels in the other treatment.

Analysis A.3.1: Usefulness of a Bar Graph with Economic Text

Presented in Table 5 are the means and SDs of Ss' scores on the economic narrative criterion test. The results of the analysis of variance of these data are presented in Table 6. A significant difference was obtained between treatments, of major concern in this study. Additionally, Scheffé tests indicated that pupils at higher grade levels performed higher than did pupils at lower grade levels (grade 9 > grade 8 > grade 7) and that pupils at higher IQ levels achieved higher scores than did pupils at lower levels (group I > group II > group III). The significant Treatment X Grade Level interaction was examined and revealed that ninth graders in Treatment A (text alone) achieved significantly higher scores than seventh graders in Treatment B (map with text). The significant triple interaction may be explained by the observation that pupils at higher grade levels and lower IQ levels in one treatment scored lower than pupils at lower grade levels and higher IQ levels in the other treatment.

Analysis A.1.2: Usefulness of Time-Line with Historical Text

Means and SDs of Ss' performance on the historical narrative criterion test are presented in Table 7 and means and SDs of Ss' IQs are presented in Table 8. The summary of the analysis of covariance of IQ scores on historical narrative criterion scores is presented in Table 9. As in analysis A.1.1 above, no significant difference was obtained between treatments. Similarly, the significant differences between grade levels, analyzed further by Scheffé tests (grade 9 > grade 8 > grade 7), was expected. Boys achieved significantly higher than did girls. This analysis revealed no significant interaction effects.

Analysis A.2.2: Usefulness of Map with Geographic Text

Means and SDs of Ss' performance on the geographic narrative criterion test are presented in Table 10 and means and SDs of Ss'

Table 5

Means and Standard Deviations of Economic Narrative Criterion Scores (Analysis A.3.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	21	322.48	78.54	15	382.33	72.63	18	391.39	107.73
	Group II	20	295.20	96.59	18	342.78	67.35	23	325.17	97.21
	Group III	55	252.27	87.08	42	271.83	72.22	54	299.26	83.90
B	Group I	29	375.03	85.44	16	437.50	109.96	15	488.27	82.12
	Group II	24	315.00	92.39	21	332.10	64.97	28	344.86	72.35
	Group III	50	294.06	92.21	57	323.07	95.17	32	363.63	78.47

Table 6

Summary of Analysis of Variance of Economic Narrative Criterion Scores (Analysis A.3.1)

Source	df	Sum of Squares	Mean Square	F
Treatments	1	8486.45	8486.45	26.87**
I.Q. Levels	2	31644.99	15822.50	50.09**
Grade Levels	2	11066.13	5533.07	17.52**
Treatment X IQ Levels	2	2757.46	1378.73	4.37**
Treatment X Grade Levels	2	667.91	333.96	1.06
IQ Levels X Grade Levels	4	2278.75	569.69	1.80
Treatment X IQ Levels X Grade Levels	4	51585.27	12896.32	40.83**
Within (Adj.)	520		315.86	

** Significant at .01 level

Table 7

Means and Standard Deviations of Historical Narrative Criterion Scores (Analyses A.1.2 and A.1.3)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	62	303.03	104.36	58	329.24	99.12	40	346.50	108.75
	F	41	284.63	73.15	34	293.44	68.81	39	328.77	89.69
B	M	48	307.25	90.33	44	327.86	89.42	46	381.07	117.03
	F	48	297.94	93.57	33	297.73	73.74	45	335.87	81.95

Table 8

Means and Standard Deviations of IQs of Pupils (Analysis A.1.2)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	62	107.48	17.97	58	106.88	15.80	40	107.65	13.87
	F	41	110.37	13.71	34	106.35	16.10	39	107.23	12.97
B	M	48	111.94	14.88	44	107.20	17.19	46	110.70	13.58
	F	48	108.17	14.43	33	103.55	12.75	45	108.09	10.98

Table 9

Summary of Analysis of Covariance of IQs
on Historical Narrative Criterion Scores (Analysis A.1.2)

Source	Original		Adjusted			
	df	Sum of Squares	df	Sum of Squares	Mean Square	F
Treatment	1	321.27	1	219.66	219.66	1.36
Grade Level	2	5293.81	2	5623.75	2811.87	17.42**
Sex	1	2043.03	1	1469.11	1469.11	9.10**
Treatment x Grade Level	2	191.52	2	64.78	32.39	<1
Treatment x Sex	1	13.48	1	41.09	41.09	<1
Grade Level x Sex	2	225.88	2	79.48	39.74	<1
Treatment x Grade Level x Sex	2	203.80	2	328.79	164.49	1.02
Within	526	107997.50	525	84762.42	161.45	

** Significant at .05 level

IQ scores are presented in Table. 11. The summary of the analysis of covariance of IQ scores on geographic narrative criterion scores is presented in Table 12. Contrary to the findings in analysis A.2.1 above, no significant difference was obtained between treatments. The difference in boys' and girls' geographic narrative scores was also non-significant. The grade level difference was again noted, and, on further examination by Scheffé tests, again in the same direction (grade 9 > grade 8 > grade 7). Interaction effects were non-significant.

Analysis A.3.2: Usefulness of a Bar Graph with Economic Text

Means and SDs of Ss' performance on the economic narrative criterion test are presented in Table 13 and means and SDs of Ss' IQ scores are presented in Table 14. The summary of the analysis of covariance of IQ scores on economic narrative criterion scores is displayed as Table 15. As in analysis A.3.1 above, significant treatment and grade level effects were observed. Ss in Treatment B (graph with text) scored higher than those in Treatment A (text alone). A series of Scheffé tests revealed that the grade level differences, as expected, were grade 9 > grade 8 > grade 7. Boys' performance did not differ significantly from girls' achievement and no significant interactions were obtained.

Analysis A.1.3: Usefulness of a Time-Line with Historical Text

Means and SDs of Ss' performance on the historical narrative criterion test were presented above in Table 7. Means and SDs of Ss' reading achievement scores are displayed in Table 16. The summary of the analysis of covariance of reading achievement scores on historical narrative criterion scores is presented in Table 17. As in analysis A.1.1 and analysis A.1.2 above, no significant treatment effect was obtained. Interestingly, a significant difference between grade levels, noted in other analyses of this data, was not revealed in this analysis. Boys' achievement was significantly higher than that of girls. No significant interaction effects were obtained.

Analysis A.2.3: Usefulness of a Map with Geographic Text

Means and SDs of Ss' performance on the geographic narrative criterion test were presented above in Table 10 and means and SDs of Ss' reading achievement scores are presented in Table 18. The summary of the analysis of covariance of reading achievement scores on geographic narrative achievement test scores is presented as Table 19. No significant main effects or interactions were obtained.

Table 10

Means and Standard Deviations of Geographical Narrative Criterion Scores
(Analyses A.2.2 and A.2.3)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	64	294.25	98.51	55	333.09	115.01	43	347.56	84.19
	F	44	299.95	88.82	36	321.28	98.98	45	313.98	85.87
B	M	46	320.96	148.53	47	338.36	87.04	43	363.35	135.90
	F	45	332.31	127.92	31	313.45	91.63	39	365.59	75.58

Table 11

Means and Standard Deviations of IQs of Pupils
(Analysis A.2.2)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	64	108.97	14.25	55	107.73	14.47	43	109.35	13.84
	F	44	106.48	12.74	36	101.97	14.94	45	107.16	12.51
B	M	46	110.07	19.86	47	106.19	18.40	43	109.21	13.65
	F	45	111.82	14.93	31	108.45	13.42	39	108.31	11.24

Table 12

Summary of Analysis of Covariance of IQs
On Geographical Narrative Criterion Scores (Analysis A.2.2)

Source	Original		Adjusted			
	df	Sum of Squares	df	Sum of Squares	Mean Square	F
Treatment	1	1279.47	1	684.86	684.86	3.00
Grade Level	2	2583.44	2	2928.74	1464.37	6.31**
Sex	1	216.78	1	82.47	82.47	<1
Treatment x Grade Level	2	730.03	2	858.82	429.41	1.88
Treatment x Sex	1	67.10	1	4.97	4.97	<1
Grade Level x Sex	2	438.66	2	328.77	164.39	<1
Treatment x Grade Level x Sex	2	304.57	2	560.85	280.43	1.23
Within	526	139262.28	525	120019.62	228.61	

** Significant at .01 level

Table 13

Means and Standard Deviations of Economic Narrative Criterion Scores (Analyses A.3.2 and A.3.3)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	60	279.82	91.87	50	309.60	85.97	53	322.09	86.46
	F	36	271.17	92.61	25	313.68	82.19	42	324.12	111.78
B	M	50	325.88	99.13	52	342.15	78.16	33	394.36	95.59
	F	53	317.83	94.21	42	347.55	124.19	42	371.48	91.58

Table 14

Means and Standard Deviations of IQs of Pupils (Analysis A.3.2)

Treatment	Sex	Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	M	60	110.73	17.26	50	106.04	17.03	53	108.04	13.81
	F	36	106.17	12.80	25	106.24	14.69	42	104.10	12.18
B	M	50	107.86	16.17	52	107.96	15.75	33	111.27	13.55
	F	53	111.23	14.64	42	104.21	20.94	42	111.29	10.55

Table 15

Summary of Analysis of Covariance of IQs On Economic Narrative Criterion Scores (Analysis A.3.2)

Source	Original		Adjusted			
	df	Sum of Squares	df	Sum of Squares	Mean Square	F
Treatment	1	6476.25	1	5097.72	5097.72	28.21**
Grade Level	2	5921.06	2	6432.79	3216.39	17.80**
Sex	1	65.74	1	97.81	97.81	<1
Treatment x Grade Level	2	353.87	2	186.12	93.06	<1
Treatment x Sex	1	44.08	1	95.99	95.99	<1
Grade Level x Sex	2	135.22	2	255.60	127.80	<1
Treatment x Grade Level x Sex	2	111.60	2	580.65	290.33	1.61
Within	526	114567.07	525	94880.24	180.72	

** Significant at .01 level

Table 16

Means and Standard Deviations of Pupils' Reading Achievement Scores (Analysis A.1.3)

Treatment	Sex	Grade 7			Grade 8		
		N	Mean	SD	N	Mean	SD
A	M	62	72.94	22.55	58	93.43	25.01
	F	41	77.10	18.78	34	89.62	22.26
B	M	48	73.13	20.05	44	83.48	23.03
	F	48	76.81	23.14	33	82.91	21.16

Table 17

Summary of Analysis of Covariance of Reading Achievement Scores on Historical Narrative Criterion Scores (Analysis A.1.3)

Source	Original		Adjusted			
	df	Sum of Squares	df	Sum of Squares	Mean Square	F
Treatment	1	52.17	1	278.99	278.99	1.95
Grade Level	1	383.91	1	161.05	161.05	1.13
Sex	1	1096.22	1	1435.22	1435.22	10.05**
Treatment x Grade Level	1	26.69	1	17.75	17.75	<1
Treatment x Sex	1	27.19	1	31.33	31.33	<1
Grade Level x Sex	1	182.64	1	51.65	51.65	<1
Treatment x Grade Level x Sex	1	1.46	1	47.43	47.43	<1
Within	360	67487.92	359	51192.15	142.88	

** Significant at .01 level

Table 18

Means and Standard Deviations of Pupils' Reading Achievement Scores (Analysis A.2.3)

Treatment	Sex	Grade 7			Grade 8		
		N	Mean	SD	N	Mean	SD
A	M	64	72.98	21.78	55	89.87	22.73
	F	44	75.41	21.30	36	84.67	21.78
B	M	46	73.07	21.10	47	84.19	24.33
	F	45	78.44	21.09	31	88.23	22.06

Table 19

Summary of Analysis of Covariance of Reading Achievement Scores on Geographical Narrative Criterion Scores (Analysis A.2.3)

Source	Original		Adjusted			
	df	Sum of Squares	df	Sum of Squares	Mean Square	F
Treatment	1	399.14	1	372.81	372.81	1.57
Grade Level	1	430.83	1	115.18	115.18	<1
Sex	1	48.33	1	130.65	130.65	<1
Treatment x Grade Level	1	474.60	1	332.53	332.53	1.40
Treatment x Sex	1	6.93	1	117.92	117.92	<1
Grade Level	1	361.56	1	167.10	167.10	<1
Treatment x Grade Level x Sex	1	43.94	1	118.37	118.37	<1
Within	360	100194.43	359	85272.16	237.53	

Analysis A.3.3: Usefulness of a Bar Graph with Economic Text

Means and SDs of economic narrative criterion scores are presented above in Table 13. Means and SDs of Ss' reading achievement scores are presented in Table 20. The summary of the analysis of covariance of reading achievement scores on economic narrative criterion scores is displayed as Table 21. As in analyses A.3.1 and A.3.2 above, a significant difference between treatments was obtained. Pupils in Treatment B (graph with text) achieved significantly higher than did pupils in Treatment A (text alone). No other main effects or interactions were noted.

Results of Series B Studies

Analysis B.1.1: Usefulness of a Time-Line with Historical Text

Means and SDs of historical narrative criterion scores are presented in Table 22 and the summary of the analysis of variance of those scores is displayed as Table 23. Unlike analysis A.1.1, a significant difference was obtained between experimental treatments. Pupils in Treatment B (time-line with text) achieved significantly higher than pupils in Treatment A (text alone). Consistent with the analysis A.1.1 results were the findings of significant differences between grade levels and IQ levels. A series of Scheffé tests revealed, as expected, that grade 9 > grade 8 > grade 7 and (IQ) group I > group II > group III. Further analysis of the Grade Level X IQ Level interaction revealed the major contributing differential effects to be seventh grade group II (middle range IQ) > eighth grade group III (lower range IQ) and ninth grade group III > seventh grade group II. The Treatment X Grade Level interaction almost reached the .05 level of significance ($p = .0511$). This effect may be explained by the observation that pupils in Treatment B (time-line with text) did not perform significantly different from those in Treatment A (text alone) at the seventh grade level but did achieve higher scores than Treatment A pupils at the eighth and ninth grade levels. No other interaction effects were noted.

Analysis B.2.1: Usefulness of a Map with Geographic Text

Means and SDs of geographic narrative criterion scores are displayed as Table 24 and the summary of the analysis of variance of those scores is presented in Table 25. All main effect differences were significant, as in analysis A.2.1. Pupils in Treatment B (map with text) achieved higher scores than those in Treatment A (map alone). Subsequent Scheffé tests revealed, as expected, that pupils in grade 9 > grade 8 > grade 7 and pupils in (IQ) group I > group II > group III. The Grade Level X IQ

Table 20

Means and Standard Deviations of Pupils' Reading Achievement Scores (Analysis A.3.3)

Treatment	Sex	Grade 7			Grade 8		
		N	Mean	SD	N	Mean	SD
A	M	60	73.40	23.48	50	85.44	25.85
	F	36	71.75	18.88	25	84.92	20.09
B	M	50	72.56	18.84	52	89.00	21.18
	F	53	80.47	22.03	42	87.14	22.99

Table 21

Summary of Analysis of Covariance of Reading Achievement Scores on Economic Narrative Criterion Scores (Analysis A.3.3)

Source	Original		Adjusted			F
	df	Sum of Squares	df	Sum of Squares	Mean Square	
Treatment	1	3166.02	1	2095.43	2095.43	13.13**
Grade Level	1	1749.00	1	24.82	24.82	<1
Sex	1	6.53	1	29.91	29.91	<1
Treatment x Grade Level	1	86.50	1	59.10	59.10	<1
Treatment x Sex	1	.46	1	30.51	30.51	<1
Grade Level x Sex	1	85.63	1	248.86	248.86	1.56
Treatment x Grade Level x Sex	1	.06	1	71.93	71.93	<1
Within	360	76409.62	359	57306.30	159.63	

**Significant at .01 level

Table 22

Means and Standard Deviations of Historical Narrative Criterion Scores
(Analysis B.1.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	86	328.07	83.73	65	351.06	78.78	57	371.12	102.28
	Group II	61	273.35	78.63	69	301.77	71.60	54	334.80	94.32
	Group III	48	272.04	57.51	76	270.29	78.75	48	287.90	90.76
B	Group I	68	315.60	94.39	69	380.20	91.07	74	416.46	101.17
	Group II	52	295.00	82.26	69	330.41	94.66	66	369.79	89.68
	Group III	47	269.68	89.65	83	263.67	78.54	95	306.58	88.50

Table 23

Summary of Analysis of Variance of Historical Narrative Criterion Scores (Analysis B.1.1)

Source	df	Mean Square	F
Treatment	1	85748.61	11.41**
Grade Level	2	290959.17	38.70**
I.Q. Level	2	632964.79	84.20**
Treatment x Grade Level	2	22187.65	2.95
Treatment x I.Q. Level	2	15633.93	2.08
Grade Level x I.Q. Level	4	26558.55	3.53**
Treatment x Grade Level x I.Q. Level	4	6396.05	<1
Within	1159	7517.56	

** Significant at .01 level

Table 24

Means and Standard Deviations of Geographic Narrative Criterion Scores
(Analysis B.2.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	86	317.74	106.98	65	362.71	84.16	57	369.07	83.40
	Group II	51	264.20	69.33	69	322.33	80.00	54	320.20	82.54
	Group III	48	283.25	93.15	76	271.57	84.28	48	292.69	83.49
B	Group I	68	336.25	94.09	69	375.32	95.10	74	393.43	120.40
	Group II	52	310.71	107.10	69	320.65	93.17	66	346.42	109.27
	Group III	47	283.19	93.54	83	278.20	77.86	95	282.81	91.74

Table 25

Summary of Analysis of Variance of Geographic Narrative Criterion Scores (Analysis B.2.1)

Source	df	Mean Square	F
Treatment	1	52837.44	6.11*
Grade Level	2	117585.86	13.59**
I.Q. Level	2	564074.59	65.19**
Treatment x Grade Level	2	5861.91	<1
Treatment x I.Q. Level	2	16047.43	1.86
Grade Level x I.Q. Level	4	30085.12	3.48**
Treatment x Grade Level x I.Q. Level	4	7856.94	<1
Within	1159	8653.19	

* Significant at .05 level
**Significant at .01 level

Level interaction may be explained by the observation that eighth grade group III (lower IQ range) pupils scored lower than did seventh grade group II (middle IQ range) pupils; that seventh grade group I (higher IQ range) pupils did not achieve significantly different from ninth grade group II pupils, that ninth grade group III pupils' performance was not significantly different from that of seventh grade group II pupils; and that seventh grade group III pupils did not achieve significantly different from seventh grade group II pupils. No other interactions were revealed.

Analysis B.3.1: Usefulness of a Bar Graph with Economic Text

Means and SDs of economic narrative criterion scores are presented in Table 26 and the summary of the analysis of variance of those scores is displayed as Table 27. As in analysis B.3.1, all main effect differences were significant and in the same direction. Pupils in Treatment B (graph with text) achieved higher than those in Treatment A (text alone). Pupils in higher grade levels and at higher IQ levels, as indicated by Scheffé tests, achieved higher than pupils at lower grade levels and at lower IQ levels (grade 9 > grade 8 > grade 7; group I > group II > group III). The Grade Level X IQ Level interaction is explained by the observation that seventh grade group I (higher IQ range) pupils achieved higher scores than both eighth and ninth grade group III (lower IQ range) pupils. Also, eighth grade group I pupils scored higher than did pupils in ninth grade groups II and III (middle and lower IQ range). No other significant interaction effects were observed.

Table 26

Means and Standard Deviations of Economic
Narrative Criterion Scores (Analysis B.3.1)

Treatment	IQ Level	Grade Level								
		Grade 7			Grade 8			Grade 9		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
A	Group I	86	294.26	94.90	65	337.92	74.82	57	377.07	107.53
	Group II	51	276.57	72.66	69	298.62	91.14	54	302.06	82.94
	Group III	48	267.94	80.93	76	271.53	82.65	48	294.29	68.86
B	Group I	68	346.51	89.69	69	390.09	88.00	74	390.76	98.13
	Group II	52	300.73	94.61	69	329.20	83.96	66	360.58	103.21
	Group III	47	296.64	81.68	83	291.12	93.84	95	292.28	104.36

Table 27

Summary of Analysis of Variance of Economic Narrative Criterion Scores (Analysis B.3.1)

Source	df	Mean Square	F
Treatment	1	268212.20	32.87**
Grade Level	2	144556.24	17.72**
I.Q. Level	2	477930.87	58.57**
Treatment x Grade Level	2	3931.65	<1
Treatment x I.Q. Level	2	16816.59	2.06
Grade Level x I.Q. Level	4	25427.17	3.12*
Treatment x Grade Level x I.Q. Level	4	14898.38	1.83
Within	1159	8159.67	

* Significant at .05 level
**Significant at .01 level

CHAPTER IV

DISCUSSION

A simple, uncomplicated answer is impossible to the motivating question of this study, "Are graphic illustrations with social studies text useful to junior high school pupils?" The findings are, on the one hand, rather unambiguous. Nevertheless, they are at the same time specific and must be related carefully in any productive generalizations.

Summary of Major Findings

Prior to any adequate discussion, the major findings of this project are stated. First, when the data were analyzed according to an analysis of variance design (treatments x IQ levels x grade levels),

1. pupils' criterion achievement was enhanced significantly by an appropriate illustration accompanying a social studies narrative;

2. pupils' criterion achievement was affected by their IQ level, that is, pupils at higher IQ levels achieved higher than pupils at lower IQ levels;

3. pupils' criterion achievement was affected by their educational level, that is, ninth grade pupils achieved higher than eighth grade pupils and eighth graders achieved higher than seventh graders.

Second, when data from the Series A experiments were analyzed in analysis of covariance designs a) in one adjusting criterion scores for IQ scores and b) in another adjusting criterion scores for reading achievement scores,

1. pupils' criterion achievement was enhanced significantly by a bar graph with economic text; and

2. pupils' criterion achievement was not enhanced significantly by either a time-line with historical text or product-distribution-type map with geographic text.

While other results were obtained, these findings are central to the purposes of the study and, consequently, of most interest.

The discussion treats the findings from all analyses, but is premised on the conviction that those from the ANCOVA analyses are the more powerful and, thus, the more conclusive and productive.

A Note on Research Design and Conclusive Findings

At the onset of the project, two types of analyses were chosen by which to treat the data. A treatments x IQ levels x grade levels analysis of variance design was one selected. The major hazard seen for this design was in the use of IQ levels as a main effect. Yet, this decision was based on the observation that in pedagogic practice, teachers, administrators and curriculum materials producers must prescribe materials and instructional procedures (treatments) to individual pupils in groups (constituted according to some guidelines such as IQ within a self-contained classroom or across classroom groups at a grade level). Since IQ is a useful predictor of school achievement and in line with previous research (9), IQ levels seemed to be an appropriate experimental main effect. That much information would be lost to the analysis by constituting IQ levels and that failure to covary IQ might result in a significant treatment effect when one did not exist in fact were seen as acceptable considering one aim of the project. Two, analyses of series A data, at least, according to ANCOVA, controlling for IQ in one analysis and reading achievement in another, were also planned, but to be conducted following the ANOVA analyses. The ANCOVA design, it was felt, would yield results more precisely of interest than the ANOVA analyses. Of most concern were treatment effects; the ANCOVA analyses would adjust criterion scores for relevant covariants and results would not be confounded by unanalyzed individual IQ effects on individual criterion scores.

Findings from the ANOVA analyses were consistent across experiments. All main effects were significant (except for the Series A study of time-line with text). In Series A, each experiment revealed a triple interaction, but, more importantly, only one yielded a Treatment x IQ Level interaction. In the Series B experiments, none revealed a Treatment x IQ Level interaction. This absence of Treatment X IQ level interactions indicated that the treatments were not having a differential effect at different IQ levels. This result was not at all consistent with those reported by some other investigators (9; 31). Consequently, only a general and undifferentiated pedagogic generalization was possible: pupils' achievement was facilitated when studying social studies text accompanied by an appropriate graphic illustration.

The subsequent analyses, not properly post hoc but surely additional analyses of the same data, added considerably to the research yield of the project. In these analyses, only one treatment (bar graph with text) was significant and this treatment effect was obtained when criterion scores were adjusted both a) by IQ and b) by reading achievement. Not one higher order interaction was obtained in any of the subsequent analyses.

The results of these analyses, by analysis of variance using an IQ level main effect and by analysis of covariance adjusting for IQ, highlight the power of the analysis of covariance design in research on school learning. Because of this power, the ANCOVA results are seen as the more conclusive. Also, school learning research which does not adjust criterion achievement for IQ or another appropriate covariable must be viewed with some skepticism. Failure to employ such an analytic procedure in previous researches very well may explain many of the inconclusive and inconsistent findings. Too, failure to use multivariate analyses may cause an investigator to reject the null hypothesis when it is true. Such a decision would have been appropriate, considering the ANOVA analyses alone. It would have been in error, however, as the ANCOVA results indicate. This type of error seems possible in previous studies related to this project (9; 31).

Differential Effects of Different Graphic Illustrations with Text

Quite obvious, it would seem, is the necessity to consider different graphic illustrations with text as separate, however related, phenomena. That is, while the three types of graphic illustrations studied in this project - time line, map, and bar graph - properly may be grouped under one label, graphic illustrations, they clearly had different effects on pupils' use. In the series A and B ANOVA analyses, the map with text and the bar graph with text both facilitated pupil learning. The inconsistent findings of the time-line with text in these analyses might be explained away - on the basis of sampling, for example - were it not for the evidence from the other two analyses performed (analyses A.-.2 and A.-.3). Those results, based on covariance analyses using IQ and reading as covariants, yielded consistent findings that the time-line with text and map with text failed to influence pupils' learning significantly, whereas the bar graph with text did make a significant difference.

The findings, at least on this point, seem to deserve generous interpretation: the effects of different graphic illustrations with text are different. This general result merits, it would seem, special attention in future preparations of curriculum materials and in classroom applications. Indeed, neither teachers nor researchers should assume similar, much less identical results from the use of different graphic illustrations with text. This finding likely may forecast more task-specific pedagogic guidelines and programs as well as more carefully delimited research efforts and interpretations.

Still, explanations for this result are not asserted with either ease or confidence. Perhaps boys and girls learned to use the bar graph with narrative and failed to learn to use the time-line and map with text during their elementary and junior high school years. If true, how does one explain the lack of impact of the host of maps with text, especially, in curriculum materials employed in elementary classrooms? Time-lines, to be sure, seem to be more used at the middle than at the primary levels; yet, pupils having had more recent experience with this type of graphic should be expected to use it in junior high school. If courses of study, curriculum materials, or teacher action is the culprit here, which possibility is neither countenanced nor denied, action in both research and curriculum development seems important. Other possibilities, still, must be considered.

Pupils may have had more experience with bar graphs with text than the other types of graphics with text. This possibility is not convincing, even in the absence of research on the frequency of types of graphics with text in social studies curriculum materials. There is one dimension of this suggestion, tangential to be sure, which merits special attention. In all likelihood, pupils in junior high school have had more experience with bar graphs, (and circle graphs, picto-graphs, etc.) than with either time-lines or maps. This experience has been focused in the mathematics program but has been buttressed in other fields as well. Pupils may have used bar graphs without text and may have constructed bar graphs more than the other graphics studied in this project. Crucial here, it would seem, is an expirically determined relationship, now absolutely lacking, between these uses of a bar graph without accompanying text and a bar graph with accompanying, relevant narrative.

Another possibility is that pupils may use bar graphs with text because they recognize this graphic illustration as a type of textual signal which commands them to pay attention to the accompanying words. Grammatical signals are used as a matter of course in understanding and using language in both spoken and written discourse. If this hypothesis be valid with respect to a bar graph with text, it does not help explain pupils' failure to use other types of graphic illustrations (specifically a map and a time-line) in the same way. The hypothesis contains the implicit suggestion that pedagogical attention be given to making pupils aware of maps and other types of illustrations as signals to attend to the verbal narrative.

The Usefulness of Graphic Illustrations with Social Studies Text: A Caution Against Uncritical Acdeptance of Effectiveness

The findings clearly fail to support an uncritical acceptance of the idea that graphic illustrations are effective with social studies text. The criterion of effectiveness in this statement is pupil learning as influenced by the presence of the specific illustration with social studies text. The generalization just asserted must not be "over-stood." Different types of graphic illustrations (e.g., time-lines, maps, bar graphs) with text are differentially effective, if facilitating to achievement at all. The findings also indicate rather transparently that pupils probably attend to the narrative - to the words and sentences - in most study tasks. At least, pupils providing data in this project probably attended to the verbal narrative. Two of the accompanying illustrations (time-line and map) seemed not to be used effectively by the pupil in his learning. The illustration was present. It may have been seen and, if it were, it may well have served as a distractor; perhaps it was not even considered. Quite likely, the presence of increased complexity (details) and, in this research, redundant details, may have inhibited additional learning. Several investigators (e.g., 20) have pointed out that additional cues in a stimulus display should not be expected to increase learning and may even elicit responses in opposition to desired learning. Samuels' recent study (22) certainly lends powerful evidence to this conclusion. His report indicated that pupils attended to the task of reading their reading textbooks when their reading materials contained no illustrations. Particularly relevant, in this regard, is the possibility that the illustrations were in effect a second stimulus mode which interferred with the human being's single-channel information processing capabilities (4; 27).

These comments, while reasonable explanations for the findings with respect to the time-line and map with text, are not entirely adequate as they stand for the situation of the bar graph with accompanying narrative. Yet, they seem to provide some productive relationships.

Junior high pupils, as determined from all analyses in this project, were found to have profited from a bar graph with social studies text. Apparently, the bar graph was noted and was used in a special way or ways. At least three prominent possibilities exist. One, the pupils used the bar graph as they read and studied the narrative. The bar graph provided them with visual referrants for the verbal descriptors, referrants with more substantial reality (or less ambiguity) than that provided by the text alone. Although the bar graph's information was redundant, that is, was identical to some significant information in the narrative, it was not organized nor presented as in the narrative and it may have helped the pupil organize the information in the narrative and/or served as reinforcement about the information to the pupil. Two, pupils used the bar graph precisely because it contained less rather than added complexity. Rather than being an illustration that added to a possible information burden, the bar graph may have stripped away the need to rely on verbal descriptors and may have reduced the information input, thereby increasing learning efficiency. This explanation fits neatly with that stated previously regarding the failure of the time-line and map with text to be useful. It seems to add support to the earlier discussion of the probable fundamental difference, at least in effects, of the bar graph and other types of graphics. Three, pupils were prompted to attend to the narrative with more concern than they were by the other two types of graphics. That is, as a type of signal, the bar graph may have served as a potent use to study for the relationships in the narrative.

These three possibilities must not preclude a fourth and more widely encompassing generalization. The bar graph (with text) may have signalled pupils' attention to the narrative, served as visual referrant to and reinforcer of the narrative, and, as a reduction and reorganization of the redundant information, served to enhance learning efficiency. This possibility seems more attractive for, rather than confining an explanation to a single category, it integrates available theory into a plausible general explanation. However appealing, it remains speculation until confirmed by future empirical inquiry.

Some Needed Research

A number of important questions are raised by the limited research available. A few are listed to illustrate the richness of this field. If pupils do not use a product-distribution type map with geographic text, do they use other types of maps with text? Do pupils use other types of graphs (e.g., circle, line) with text? Is the use of graphic illustration with text related to the use of color (or lack of colors), to the size of illustration, to the caption, to the placement of the illustration near the beginning, middle, or conclusion of the appropriate narrative? Is use related to directions in the narrative (e.g., "Look at the map on this page." "What major agricultural crop is produced less than cotton?" "See Figure 23, page 165.") With special instruction, can pupils learn to use graphic illustrations with text even better than they do? What pupil characteristics (e.g., educational level, memory, spatial orientation) are related to using specific graphic illustrations with text? How do pupils use photographs and drawings as illustrations with social studies text? Are photographs and drawings with text used like graphic illustrations with text are used? Information obtained about these and related questions likely would add both fundamental knowledge and practical suggestions for the improvement of social studies education for children and youth.

8

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Conclusions

The major findings, presented earlier, are summarized here in terms of the three hypotheses stated at the outset and of generalizations attendant to those results.

With respect to Hypothesis 1, graphic illustration with social studies text is superior to text alone in facilitating pupils' learning. This result seems to hold for the conditions of map with text and bar graph with text (and probably for time-line with text), *when IQ and/or reading achievement is not controlled* in the analyses. That pupils at higher grade levels achieve more than pupils at lower grade levels and pupils at higher IQ levels score higher than those at lower IQ levels is unrelated to effects of treatment.

In regard to both Hypotheses 1 and 2, a bar graph with accompanying text is superior to text alone, but there is no significant difference between pupils' learning using a time-line with text and text alone and between a map with text and text alone.

These results highlight both methodological and substantive conclusions.

1. Research design on problems such as this one must not simply *account* for intellectual and important achievement factors (e.g., IQ and reading achievement); it must "control" for them. That is, the ANOVA design employed in analyses A.-.1 and B.-.1 yielded some results which must be viewed as artifacts of the design employed. This design used IQ levels as a main effect therby losing the IQ effect on individual criterion scores. Results obtained with the ANCOVA design clearly demonstrate the desirability of controlling for important individual characteristics (e.g., IQ and reading achievement). When individual criterion scores were adjusted for the individual's scores (IQ and reading achievement), treatment differences were in all cases reduced substantially from the ANOVA results; in only one treatment, bar graph with text, did the treatment effect persist over all analyses. That this difference was found points up the very real significance of that treatment.

2. Graph with text is not a generally superior treatment for junior high school pupils over text alone. Bar graph with

accompanying social studies text was found to foster more pupil learning than text alone. Neither a time-line with text nor a product-distribution-type map with text facilitated pupil learning more than did the text alone.

Implications and Recommendations

A major suggestion arising from this project is that, in such research on school learning, multivariate research designs and analytic techniques be employed. Quite possibly, the failure adequately to control for relevant personal characteristics of learners may account for many of the inconclusive and inconsistent research results reported, both in the past and currently. Additionally, the use of univariate models may well yield spurious results, findings which will cause the researcher to reject the null hypothesis when in fact it is true.

This suggestion is not advanced to denegrate the efforts of those who have labored to provide a proper research base for educational practice. While some past results may be invalid because of the use of less powerful, even inadequate research procedures, recognition must be clear that multivariate techniques are both of recent vintage and, as yet, still not well known. The need to replicate, if possible, many earlier studies and to pursue the leads revealed surely is transparent.

Quite necessary is serious consideration of the curriculum relevance of the substantive findings of this project. At least two major sets of activites may be suggested.

One, authors and publishers should give quite specific attention to the use of graphic illustrations with accompanying textual narrative. The verbal narrative usually is prepared first and, probably in many cases, without attention to appropriate illustration. In the subsequent editorial process, therefore, attention must be given to the graphic illustrations to be used. Not only must the illustrations be selected and prepared, quite likely necessary are two other steps.

The previously prepared narrative may need to be revised to incorporate verbal matter which directs pupils' attention to the illustration (e.g., "On the map on page 39, use your finger to trace the course of the Nile river from its source to its mouth." "Using the time-line on page 136, what major events occurred between _____ and _____?" "How different would the bar graph be to incorporate this data, etc.?" "Look at the coastal area of _____on the map above.") Another editorial imperative would seem to be the inclusion in the teachers' guide of suggestions which the author believes will aid pupils in using the graphic illustrations in conjunction with the narrative.

These suggestions undoubtedly must be based, unfortunately for some time to come, only on the best pedagogic experience available. Soon, hopefully, research validated procedures useful in the preparation of materials may be employed. To be sure, support of this type of research by educational publishing houses would seem to be in their own self interest as well as a major contribution to building a more adequate research foundation in education.

Two, efforts should be initiated promptly to develop and test in classroom practice a variety of suggested procedures for teaching pupils at various levels to use illustrations with text. As these ideas receive first trials in classrooms, they should receive some dissemination, at least to other teachers in a system and possibly through the medium of a curriculum guide. As other teachers use the procedures and suggest revisions and additional ideas, the guide should be modified. Such practices are not at all uncommon for other topics (e.g., teaching mathematics) and should be beneficial in this area of concern. Procedures, as believed useful, should be more widely disseminated.

The need for additional research, conventionally expected in research reports, must be asserted here, but not as a perfunctory bow to custom. Only a handful of studies, including this one, have been reported on the problem of school learners' use of illustration with text, much less graphic illustrations with text. Taken together, these studies constitute both an important beginning and an impressive contribution. They do not, however, define the dimension of the problem field nor even major dimensions of the field. They do illuminate the abundant lack of knowledge about this major problem rather than an accumulation of productive results. Consequently, inquiry into this domain merits high priority.

A number of important research questions were listed in Chapter IV. Researchers who are attracted to this problem area may find this short list useful. Surely, the questions are presented with considerable seriousness; they require empirical study as means of advancing the research base of education and of building better programs for learners in school. While this research should continue to use the social studies as one context for study, the general inquiry should be broadened to all curriculum fields. Research efforts should also consider the general problem of effectiveness of pictorial illustrations with text and not be limited to study only of graphic illustrations with text.

CHAPTER VI

SUMMARY

This project sought to explore the effectiveness of using certain graphic illustrations with accompanying text in promoting pupil learning in the social studies.

Graphic illustrations are used with text for three major reasons. As primary messages, they present information supplementary to that presented in the accompanying narrative. They also serve as organizers or reinforcers for information presented by words in the text, the most common use in school materials. They may also serve a decorative purpose.

While a considerable body of research has been directed to school learners' use of graphs, most of these studies have dealt with different types of graphs as primary messages. This evidence really seems irrelevant to issues relating to pupils' use of graphic illustrations with text. Only a very few studies have investigated dimensions of this latter problem, probably the more important pedagogic one. As a result, this project was designed to investigate some untested assumptions regarding the use of graphic illustrations with text.

Three types of graphic illustrations with accompanying text were the objects of research attention in this project. These three were 1) time-line, 2) product-distribution-type map, and 3) bar graph. Subjects were junior high school pupils. Two series of studies were undertaken in this project. Both utilized common experimental materials and criterion tests, and similar procedures. Data obtained in both series of studies were analyzed in a 2(treatments) X 3(grade levels) X 3(IQ levels) analysis of variance design. Data from one series were also treated a) in a 2(treatments) X 3(grade levels) X 2(sex) analysis of covariance design adjusting for Ss' IQ scores and b) in a 2(treatments) X 2(grade levels) X 2(sex) analysis of covariance design adjusting for Ss' reading achievement scores.

Results obtained in this project are both methodological and substantive. They demonstrate the desirability of using multivariate designs and analyses in research on school learning. To use simpler designs is to risk rejecting the null hypothesis when in fact it is true. The major substantive findings may be summarized as follows. A bar graph with text is superior to text alone in facilitating junior high school pupils' learning in social studies. On the other hand, a time-line with text and a product-distribution-type map with text are not superior to text alone.

These findings were discussed with respect to curriculum use of the specific graphic illustrations studied in this project. Additionally, explanations were advanced for the findings in view of recent research and theory on single-channel information processing by human beings and on audiovisual utilization. Several implications of the results were asserted and recommendations were advanced for efforts in the production of curriculum materials, in local curriculum improvement, and for additional serious inquiry into this problem area.

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APPENDIX A

FOR RESEARCH PURPOSES ONLY

IMPORTANT

Do NOT open this booklet until directed.

Please do not question or talk among yourselves during this period.

Directions

This booklet contains a short narrative about India. You will be given 15 minutes to read and to study this story. After this study time, you will be asked to answer some questions.

Please study the story until you are asked to stop. At that time, close the booklet and wait for more instructions. Do not write or mark on these booklets.

Remember, please do not question or talk among yourselves until all materials are collected.

Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

India's Road to Independence

As Europeans began to explore the Americas, they also turned their eyes thousands of miles from the western hemisphere to India. Several countries sought settlements in India, but Britain's efforts overcame its rivals. As a result, the British controlled this large region, and, in 1877, India officially became a part of the British Empire.

India's primary value to Britain was commercial. As a result, England profited and English merchants and a few Indians acquired great wealth. But the Indian masses did not prosper. Almost from the beginning of British influence in this land, groups of Indians rebelled against English rule. A particularly bitter revolt, the Indian Mutiny, began in 1857. Lasting a year, it was crushed only after fierce fighting. Indians' desire for freedom continued.

During the first two decades of the twentieth century, several groups organized to seek political independence for India. Some of these national groups wanted a larger share for Indians in the government of India. Other groups sought immediate independence and stimulated riots throughout the country. From 1909 to 1914, northern India was overrun by terrorists.

Nationalist organizations, even with their spirit, are poor without good leaders to unite them. For India, such a leader did emerge --

Mohandas K. Gandhi. An Indian native, Gandhi first attracted attention and respect in both India and Great Britain by his activities in South Africa. There, from 1906 to 1914, he worked successfully for rights for the Hindus of that country by employing a method of non-violent non-cooperation. Gandhi returned to India in December, 1914, as "Mahatma," the Holy One or Great Teacher. The following May, he established a seminary near Ahmadabad where he worked for the next several years to bring his ideas to the Indian masses.

While Gandhi was beginning his work for Indian independence, nationalistic sentiment increased among the Indian masses. Some influential Englishmen thought it wise to grant some of the wishes of the Indians in hopes of preventing additional riots and possibly rebellion. Consequently, the Montagu-Chelmsford Report, published in 1918, suggested several important political reforms. These were instituted by the India Act of 1919. For example, the British majority in the central legislature at Delhi was abolished, and the provincial governments received their first elements of responsible power. Some Indians were pleased by these reforms; many others believed too little was done. Rebellion broke out in the Punjab region in 1919. Riots occured in Delhi and other cities. Trains were held up and Europeans were murdered.

The turbulent year of 1919 saw Gandhi actively enter the political struggle for home rule. In that year, the British Parliament passed

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the Rowlatt Act. This law gave British officials in India the right to judge court cases without trial and also to jail suspected terrorists. The Act was an attempt to curb the mounting desire for independence in India. When the Act passed, Gandhi appealed to his country to observe a day of national humiliation and prayer. Thus began the now famous "passive" protest movement in India. Gandhi stressed that the protest should not be violent, and that it take the form of non-cooperation with the British.

For three years, active non-cooperation was only partially successful. Gandhi halted the movement in 1922 when a riot left twenty-one policement dead. Gandhi was jailed for his leadership of the non-cooperation movement in the same year. During his imprisonment, an associate, Jawaharlal Nehru, began to exercise political leadership of Gandhi's nationalistic group.

From 1923 to 1932, terror roamed India. Murder of Englishmen was not uncommon. Police officials were assassinated. In 1929, bombs were thrown into the legislative assembly at Delhi. An attempt was made the same year to destroy the Viceroy's train. Violence was met with force. And Indians remained subjects of Great Britain.

In 1928, moderate Indian nationalists pressed for self-government within the Empire. The following year, Lord Irwin, the Viceroy, announced that dominion status was definitely the goal for India. As part of the British dominion, India would share in mutually beneficial trade and military agreements with England. This British answer

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disappointed even the moderates. Some nationalists again called for complete and immediate independence.

The stage was set for massive civil disobedience in 1930. Gandhi demanded that the British do away with alcoholic drink, lower the land tax by half, abolish the tax on salt, and reduce the military budget by half. As expected, Lord Irwin refused the demands. Gandhi and his followers reacted with their campaign of civil disobedience. In March of 1930, Gandhi and 79 others marched 170 miles to the sea to defy the monopoly on salt manufacture held by the government. With this Salt March, civil disobedience became the major weapon of the Indian nationalists. Tax collection was resisted; railroad workers walked off their jobs; Indian officials in the government resigned; liquor shops and foreign businesses were boycotted. The Congress Party under Gandhi's leadership threw its full weight into the fight to paralyze the government. The British arrested thousands.

The entire decade of the 1930's was a period of political action by Gandhi and other Congress Party members. Important roundtable discussions were held between the British and the Indians. Near the end of the decade, serious internal tension increased between two Indian factions, the Hindus and Muslims. The differences between them were both religious and cultural. The Muslim leaders were suspicious that an independent India would mean Hindu domination of the government. Efforts to resolve the friction were unsuccessful.

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Great Britain's primary concerns, moreover, were not in India but in Europe. There, World War II threatened and finally came in 1939. In August of 1940, the British repeated the goal of dominion status for India and urged Indians to fight against Nazi Germany. Even though the leaders of the Congress Party refused to cooperate, thousands of Indian troops did fight beside British soldiers in the war struggle.

At the close of the hostilities in 1945, Indian Muslims and Hindus still could not find common issues on which to build a single independent nation. However, in England, the Labor Party defeated the Conservatives at the polls and unlocked the door to Indian Independence. England's new Labor government proposed that India should become independent, and without undue delay. Convinced that the Hindus and Muslims could not agree on a plan for a single nation, Lord Mountbatten, the last Viceroy of India, announced that Britain would transfer power to two governments, India and Pakistan.

The Independence Bill was passed by the British Parliament on July 4, 1947. Six weeks later, on August 14, India and Pakistan, new nations, entered the world picture. Over fifteen years have passed since their independence, but problems between the two nations still exist. For example, the region of Kashmir remains a thorny dispute. Both countries are working to build their economies. Both have aided U. N. peace-keeping efforts. In both, a battle for minds is waged by communists and anti-communists. The nations are trying to maintain their hard won independence.

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APPENDIX B

FOR RESEARCH PURPOSES ONLY

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Directions

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Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

B-1

The Climate of India

India is often referred to as a sub-continent because of its size and climate. It is separated from the rest of Asia by the towering Himalaya Mountains. These mountains, located on its northern border, protect India from the severe winter winds of central Asia and contribute to India's monsoon climate.

A monsoon is a wind which reverses its direction between land and adjacent water on a seasonal basis. Most people think of a "monsoon" as torrential rains. However, monsoon winds do not always bring rain to India. For the most part, rain accompanies the summer monsoon, but not the winter monsoon. One result of this monsoon climate is India's tropical and semi-tropical types of vegetation.

Atmospheric conditions necessary to the summer monsoon build up during April and May. The sun beats down upon the earth. As the temperature increases, the heated air rises, thereby creating low pressure areas. These "lows" develop in southwestern India and also in central Asia. During the same time, south of the equator and over the Indian Ocean, air temperatures are much cooler, thus creating a high air pressure zone. As the temperature increases in India, the ocean air bursts from the high pressure zone into the overland low pressure zone.

This northeasterly flow of air from the ocean to land is the summer monsoon wind. As the air currents rush over the Arabian Sea, they add moisture and carry it toward India. Arriving over southern India, this water-laden air must rise in order to cross the Western Ghats. Flowing over this range of hills, the air is cooled. Since cool air cannot hold as much water vapor as can warm air, rain falls. Indeed, the rainfall is quite heavy. During the summer months from June to September, India's southwestern coast receives over 80 inches of rain. Here a tropical evergreen forest abounds. Rice is an important farm crop. Bombay, an important seaport, is located in this region of heavy rainfall.

After crossing the Western Ghats, the monsoon winds drop nearer the earth and continue to bring rain, but in decreasing amounts as the winds move toward the east coast of India. Wheat and cotton are grown in this central area with its less abundant rainfall (20-40 inches annually). The forest cover in cental India is termed "tropical," but the land is really a grassland. Through the centuries, the inhabitants of this region have cut down the forest to make land available for cultivation.

In the northwestern section of India, the monsoon winds, after coming over the Arabian Sea, continue over the land, but do not bring rain. No mountains cause the winds to rise and cool because the land is level in this part of India. Consequently, only 10 to 20 inches of rain fall in this region each year. Wheat and cotton are crops common to the area. In recent years, irrigation projects in this northwestern section

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and in northcentral India have decreased the exclusive reliance on rainfall for available water supply. The Ganges river in this region is a principal source of irrigation water. Deep water wells also are used in this area.

The monsoon winds crossing the Bay of Bengal plunge toward central Asia. However, the Himalaya Mountains, with some peaks over 25,000 feet high, block the winds' path and divert them to the northwest. As the winds rise over the mountains, they cool and deluge the area with rain. These heavy rains cause northeastern India to be very wet. In some places, for example, annual rainfall amounts to over 400 inches. Cherrapunji, lying in the foothills of the Himalayas, is the wettest place in the world. It averages some 428 inches of rain in a year. Most of the rain in this area falls during just three months, the summer monsoon season of June to September. This northeastern part of India has a tropical wet evergreen forest. Hills in this region are cleared as sites for tea plantations.

Some of the monsoon air mass reaching northeastern India is directed westward up the Ganges Valley alongside the Himalayas. As the winds travel westward, they bring heavy rains to the region until they become dry winds in northwest India. Consequently, rainfall decreases from east to west in the Ganges Valley. Both sugar cane and rice are grown in the central and eastern portions of the Valley. Calcutta, a famous seaport at the mouth of the Ganges, receives some 46 inches of rainfall annually. Delhi and New Delhi in the western section of the Valley,

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receive from 20-40 inches of rainfall annually.

In September, the summer monsoon winds gradually diminish. The earth in India and central Asia becomes cooler as the winter season approaches. Over the Indian Ocean, however, the air is now warm. The air pressure system, thus, is reversed from that in the spring; the high pressure area is over land (India) and the large low pressure area is over the ocean. This situation gives birth to the winter monsoons. They sweep southwesterly across the land toward the ocean. These winter monsoon winds, for the most part, are dry winds. An exception are the winds which flow over southeastern India after crossing the Bay of Bengal. These monsoon currents must pass over the Eastern Ghats in order to reach the low pressure area over the Indian Ocean. Cooled as they pass over these hills, the winds bring rain to the area. Thus, east of these hills rain falls in the winter as heavily as it does in the summer. A tropical dry evergreen forest grows here. The most famous city in this region is Madras. South of the city, tea is a major crop.

Most of India's people live either along the coasts or in the Ganges Valley. Here, the soil is fertile and rain is plentiful. Farming and trade, consequently, are important to the economy of these regions. India's two largest cities are located in areas of great rainfall. Both having a population of more than one million, Calcutta lies on the northeast coast and Bombay on the west coast.

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The monsoon climate is an important influence on India. It affects both the country's vegetation and agricultural crops. The climate also affects the people.

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APPENDIX C

FOR RESEARCH PURPOSES ONLY

0297

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Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

C-1

Farm Production in India

Indian agriculture, like the entire country, is marked by great contrasts. For example, India has more cattle than any other country in the world. Yet its people suffer from malnutrition and many are hungry to the point of starvation. One reason for this situation is the Hindu belief in the "sacred cow." Hindus constitute about 85 per cent of India's population and their religion forbids the eating of meat. Consequently, cattle are never slaughtered. Other agricultural contrasts also are evident. In India, the burden for providing foodstuffs for the people rests on the crop farmer.

Most of India's farmers live in small villages. Each cultivates three or four acres nearby which he either owns or leases. The small farm plots are really rather inefficient and unproductive. Farm practices are difficult to improve, moreover, because most Indian farmers are content with traditional methods, are illiterate, and are suspicious of change. The climate also limits the land area suitable for growing crops. Vast areas are too dry to support food crops, and other areas receive so much rain that dense vegetation covers the land. Actually, less than half of India's total area is useful for crops. Even so, improvement of crop types and farming methods could increase crop production.

Of all agricultural products, sugar cane is the largest cash crop for the farmer in India. Most of the sugar cane is grown in the Ganges

Plain. In other areas, this crop requires irrigation. Indian sugar cane yields are generally low, averaging about 3,000 pounds of raw sugar per acre. This yield is less than a quarter of Javanese and Hawaiian yields, though not far below those of Cuba and Brazil. In the 1960-61 period, ten million tons of sugar cane were produced in India. Even with this production, the crop does not add materially to the Indians' meager diet.

Rice is the principle foodgrain grown in India and is a staple in the diet of most Indians. Some thirty-four million tons of rice were produced during the period of 1960-61. This production is roughly equal to that of all other foodgrains combined. The high temperature and water requirements of paddy rice make it primarily a crop of the deltas and floodplains. Since rice is so preeminently a "wet crop," many people mistakenly believe that it is grown almost entirely by irrigation. Yet on most Indian rice farms, needed water is supplied by the rain on the fields themselves or by natural flood. This water is retained on the fields by low mud field-walls. Irrigation is necessary where the rainfall averages less than 40-45 inches per year.

Even though basic to the Indian diet, rice is low in nutritional value. In addition, it loses some food value through mechanical milling and polishing. A diet based on milled rice is culturally favored, but this rice possess little needed vitamin B. Consequently, the diet predisposes the masses to beri-beri. This is one of the most serious

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deficiency diseases of India.

Another important foodstuff in India is wheat. Yet, only eleven million tons were produced four years ago. Wheat is grown in the dry northwest section of the country. Its greatest use is as a basic ingredient in unleavened bread.

Millet production employs a total acreage about equalling that used for rice, but millet yields are lower than rice. In 1960-61, about sixteen million tons of millet were produced. Most of this crop is consumed in the country. Resembling barley in appearance, millet is richer in food value than is rice. An important type of Indian millet is ragi. This millet, while widely eaten in India, has a low esteem. In fact, it is often regarded as food suitable for poor and ignorant villagers - and for prisoners.

Other than wheat, the only temperate cereals grown on a large scale are barley and maize. These are particularly useful as "catch" crops on poor soils or in bad years. A "catch" crop is one employed on soils which will not support higher valued crops such as rice and sugar cane. Barley and maize are also valuable as "nitrogenizers" to the soil. They are added to most Indian curries, a famous dish of the country. Taken together, their 1960-61 production did not exceed seven million tons.

Other food crops are generally neglected. Lack of storage and transport facilities plus low purchasing power of the Indian masses

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account for this diatetically deprived situation. However, some fruits are grown, including mangoes, oranges, and bananas. Chillies (peppers) are widely produced and provide an inexpensive, often-used flavoring to the rice diet.

American agricultural advisers have worked to improve the efficiency of Indian farming. Their efforts have not been spectacular. For example, corn has been grown on experimental farms but has not been widely adopted as a crop. Small land plots and traditional diet preferences have slowed progress. Too, Indian farmers do not have the necessary equipment for large scale corn farming. Growing corn would cost more at first. So, corn, potentially valuable to Indian farm production, is not an important crop now.

India's agricultural contrasts hinder its growth toward a modern, efficient, and healthy nation. As a large cattle country, its people do not eat beef. Rice is produced in quantity, but cultural practice causes its nutritional value to be lost in milling. Large scale agricultural improvement programs meet opposition from the poverty and the attitudes of the farmers. Elimination of some of the agricultural contrasts may be a key to solving India's serious food problem.

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APPENDIX D

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Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

India's Road to Independence

As Europeans began to explore the Americas, they also turned their eyes thousands of miles from the western hemisphere to India. Several countries sought settlements in India, but Britain's efforts overcame its rivals. As a result, the British controlled this large region, and, in 1877, India officially became a part of the British Empire.

India's primary value to Britain was commercial. As a result, England profited and English merchants and a few Indians acquired great wealth. But the Indian masses did not prosper. Almost from the beginning of British influence in this land, groups of Indians rebelled against English rule. A particularly bitter revolt, the Indian Mutiny, began in 1857. Lasting a year, it was crushed only after fierce fighting. Indians' desire for freedom continued.

During the first two decades of the twentieth century, several groups organized to seek political independence for India. Some of these national groups wanted a larger share for Indians in the government of India. Other groups sought immediate independence and stimulated riots throughout the country. From 1909 to 1914, northern India was overrun by terrorists.

Nationalist organizations, even with their spirit, are poor without good leaders to unite them. For India, such a leader did emerge --

Mohandas K. Gandhi. An Indian native, Gandhi first attracted attention and respect in both India and Great Britain by his activities in South Africa. There, from 1906 to 1914, he worked successfully for rights for the Hindus of that country by employing a method of non-violent non-cooperation. Gandhi returned to India in December, 1914, as "Mahatma," the Holy One or Great Teacher. The following May, he established a seminary near Ahmadabad where he worked for the next several years to bring his ideas to the Indian masses.

While Gandhi was beginning his work for Indian independence, nationalistic sentiment increased among the Indian masses. Some influential Englishmen thought it wise to grant some of the wishes of the Indians in hopes of preventing additional riots and possibly rebellion. Consequently, the Montagu-Chelmsford Report, published in 1918, suggested several important political reforms. These were instituted by the India Act of 1919. For example, the British majority in the central legislature at Delhi was abolished, and the provincial governments received their first elements of responsible power. Some Indians were pleased by these reforms; many others believed too little was done. Rebellion broke out in the Punjab region in 1919. Riots occured in Delhi and other cities. Trains were held up and Europeans were murdered.

The turbulent year of 1919 saw Gandhi actively enter the political struggle for home rule. In that year, the British Parliament passed

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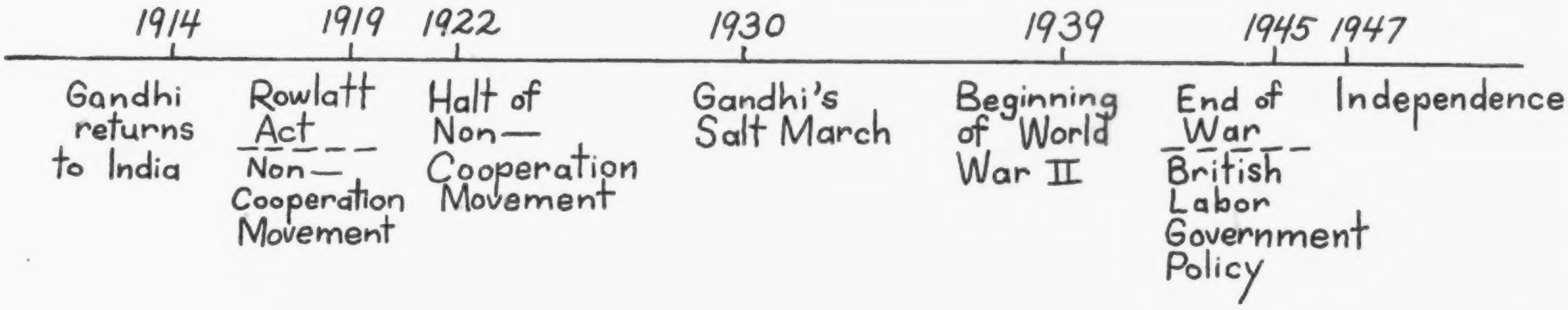
the Rowlatt Act. This law gave British officials in India the right to judge court cases without trial and also to jail suspected terrorists. The Act was an attempt to curb the mounting desire for independence in India. When the Act passed, Gandhi appealed to his country to observe a day of national humiliation and prayer. Thus began the now famous "passive" protest movement in India. Gandhi stressed that the protest should not be violent, and that it take the form of non-cooperation with the British.

PROGRESS TOWARD INDIAN INDEPENDENCE



1914
Gandhi returns to India
1919
Rowlatt Act
Non—Cooperation Movement
1922
Halt of Non—Cooperation Movement
1930
Gandhi's Salt March
1939
Beginning of World War II
1945
End of War
British Labor Government Policy
1947
Independence

For three years, active non-cooperation was only partially successful. Gandhi halted the movement in 1922 when a riot left twenty-one policemen dead. Gandhi was jailed for his leadership of the non-cooperation movement in the same year. During his imprisonment,

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an associate, Jawaharlal Nehru, began to exercise political leadership of Gandhi's nationalistic group.

From 1923 to 1932, terror roamed India. Murder of Englishmen was not uncommon. Police officials were assassinated. In 1929, bombs were thrown into the legislative assembly at Delhi. An attempt was made the same year to destroy the Viceroy's train. Violence was met with force. And Indians remained subjects of Great Britain.

In 1928, moderate Indian nationalists pressed for self-government within the Empire. The following year, Lord Irwin, the Viceroy, announced that dominion status was definitely the goal for India. As part of the British dominion, India would share in mutually beneficial trade and military agreements with England. This British answer disappointed even the moderates. Some nationalists again called for complete and immediate independence.

The stage was set for massive civil disobedience in 1930. Gandhi demanded that the British do away with alcoholic drink, lower the land tax by half, abolish the tax on salt, and reduce the military budget by half. As expected, Lord Irwin refused the demands. Gandhi and his followers reacted with their campaign of civil disobedience. In March of 1930, Gandhi and 79 others marched 170 miles to the sea to defy the monopoly on salt manufacture held by the government. With this Salt March, civil disobedience became the major weapon of the Indian nationalists. Tax collection was resisted; railroad workers walked off their jobs; Indian officials in the government resigned; liquor shops and foreign

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businesses were boycotted. The Congress Party under Gandhi's leadership threw its full weight into the fight to paralyze the government. The British arrested thousands.

The entire decade of the 1930's was a period of political action by Gandhi and other Congress Party members. Important roundtable discussions were held between the British and the Indians. Near the end of the decade, serious internal tension increased between two Indian factions, the Hindus and Muslims. The differences between them were both religious and cultural. The Muslim leaders were suspicious that an independent India would mean Hindu domination of the government. Efforts to resolve the friction were unsuccessful.

Great Britain's primary concerns, moreover, were not in India but in Europe. There, World War II threatened and finally came in 1939. In August of 1940, the British repeated the goal of dominion status for India and urged Indians to fight against Nazi Germany. Even though the leaders of the Congress Party refused to cooperate, thousands of Indian troops did fight beside British soldiers in the war struggle.

At the close of the hostilities in 1945, Indian Muslims and Hindus still could not find common issues on which to build a single independent nation. However, in England, the Labor Party defeated the Conservatives at the polls and unlocked the door to Indian Independence. England's new Labor government proposed that India should become independent, and without undue delay. Convinced that the Hindus and Muslims could

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not agree on a plan for a single nation, Lord Mountbatten, the last Viceroy of India, announced that Britain would transfer power to two governments, India and Pakistan.

The Independence Bill was passed by the British Parliament on July 4, 1947. Six weeks later, on August 14, India and Pakistan, new nations, entered the world picture. Over fifteen years have passed since their independence, but problems between the two nations still exist. For example, the region of Kashmir remains a thorny dispute. Both countries are working to build their economies. Both have aided U. N. peace-keeping efforts. In both, a battle for minds is waged by communists and anti-communists. The nations are trying to maintain their hard won independence.

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APPENDIX E

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The Climate of India

India is often referred to as a sub-continent because of its size and climate. It is separated from the rest of Asia by the towering Himalaya Mountains. These mountains, located on its northern border, protect India from the severe winter winds of central Asia and contribute to India's monsoon climate.

A monsoon is a wind which reverses its direction between land and adjacent water on a seasonal basis. Most people think of a "monsoon" as torrential rains. However, monsoon winds do not always bring rain to India. For the most part, rain accompanies the summer monsoon, but not the winter monsoon. One result of this monsoon climate is India's tropical and semi-tropical types of vegetation.

Atmospheric conditions necessary to the summer monsoon build up during April and May. The sun beats down upon the earth. As the temperature increases, the heated air rises, thereby creating low pressure areas. These "lows" develop in southwestern India and also in central Asia. During the same time, south of the equator and over the Indian Ocean, air temperatures are much cooler, thus creating a high air pressure zone. As the temperature increases in India, the ocean air bursts from the high pressure zone into the overland low pressure zone.

This northeasterly flow of air from the ocean to land is the summer monsoon wind. As the air currents rush over the Arabian Sea, they add moisture and carry it toward India. Arriving over southern India, this water-laden air must rise in order to cross the Western Ghats. Flowing over this range of hills, the air is cooled. Since cool air cannot hold as much water vapor as can warm air, rain falls. Indeed, the rainfall is quite heavy. During the summer months from June to September, India's southwestern coast receives over 80 inches of rain. Here a tropical evergreen forest abounds. Rice is an important farm crop. Bombay, an important seaport, is located in this region of heavy rainfall.

After crossing the Western Ghats, the monsoon winds drop nearer the earth and continue to bring rain, but in decreasing amounts as the winds move toward the east coast of India. Wheat and cotton are grown in this central area with its less abundant rainfall (20-40 inches annually). The forest cover in cental India is termed "tropical," but the land is really a grassland. Through the centuries, the inhabitants of this region have cut down the forest to make land available for cultivation.

In the northwestern section of India, the monsoon winds, after coming over the Arabian Sea, continue over the land, but do not bring rain. No mountains cause the winds to rise and cool because the land is level in this part of India. Consequently, only 10 to 20 inches of rain fall in this region each year. Wheat and cotton are crops common to the area. In recent years, irrigation projects in this northwestern section

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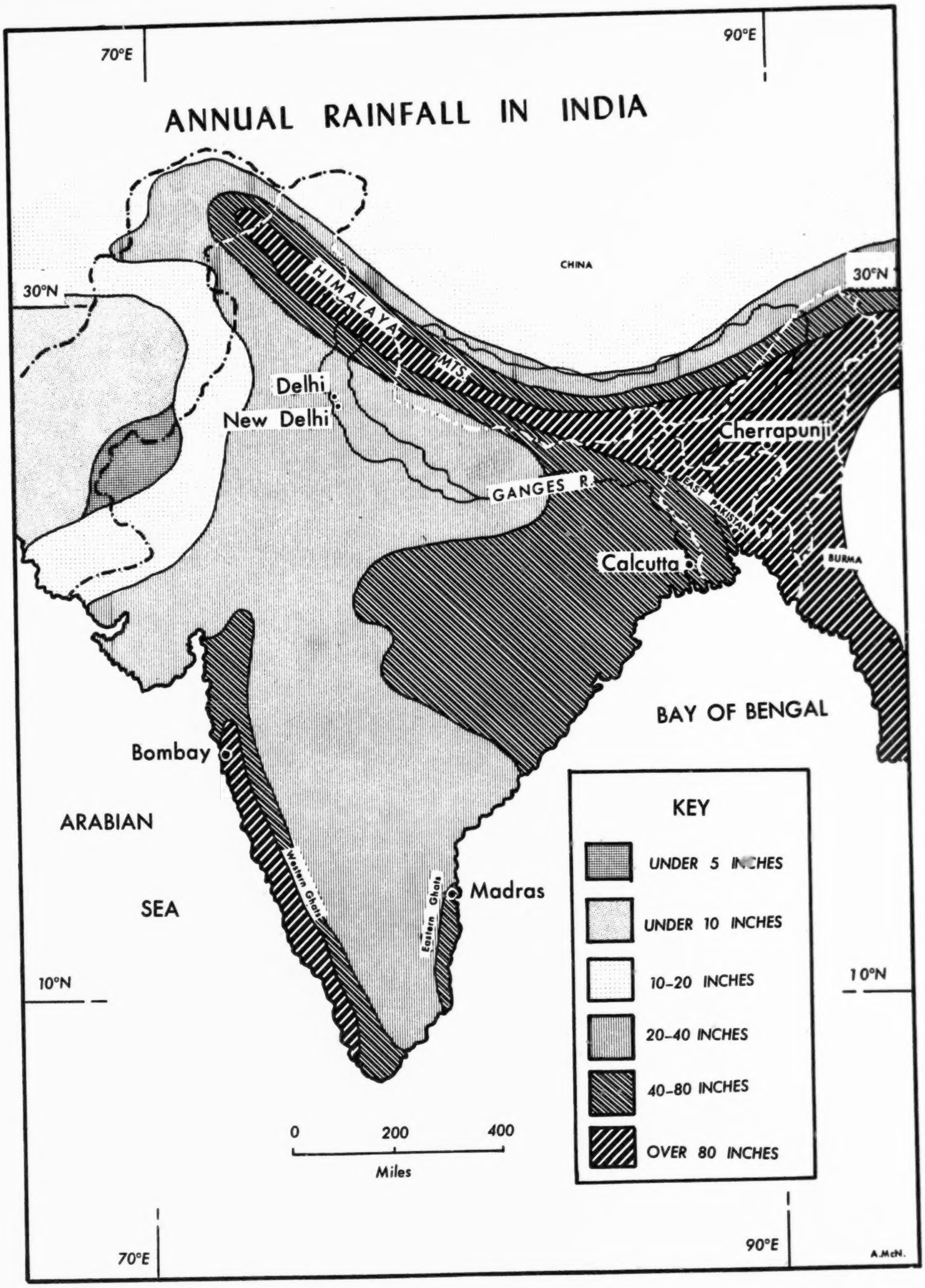

ANNUAL RAINFALL IN INDIA

70°E
90°E
30°N
30°N
CHINA
HIMALAYA MTS.
Delhi
New Delhi
GANGES R.
EAST PAKISTAN
Cherrapunji
Calcutta
BURMA
BAY OF BENGAL
Bombay
ARABIAN SEA
Western Ghats
Eastern Ghats
Madras
10°N
10°N
KEY
UNDER 5 INCHES
UNDER 10 INCHES
10-20 INCHES
20-40 INCHES
40-80 INCHES
OVER 80 INCHES
0
200
400
Miles
70°E
90°E
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and in northcentral India have decreased the exclusive reliance on rainfall for available water supply. The Ganges river in this region is a principal source of irrigation water. Deep water wells also are used in this area.

The monsoon winds crossing the Bay of Bengal plunge toward central Asia. However, the Himalaya Mountains, with some peaks over 25,000 feet high, block the winds' path and divert them to the northwest. As the winds rise over the mountains, they cool and deluge the area with rain. These heavy rains cause northeastern India to be very wet. In some places, for example, annual rainfall amounts to over 400 inches. Cherrapunji, lying in the foothills of the Himalayas, is the wettest place in the world. It averages some 428 inches of rain in a year. Most of the rain in this area falls during just three months, the summer monsoon season of June to September. This northeastern part of India has a tropical wet evergreen forest. Hills in this region are cleared as sites for tea plantations.

Some of the monsoon air mass reaching northeastern India is directed westward up the Ganges Valley alongside the Himalayas. As the winds travel westward, they bring heavy rains to the region until they become dry winds in northwest India. Consequently, rainfall decreases from east to west in the Ganges Valley. Both sugar cane and rice are grown in the central and eastern portions of the Valley. Calcutta, a famous seaport at the mouth of the Ganges, receives some 46 inches of rainfall annually. Delhi and New Delhi in the western section of the Valley,

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Farm Production in India

Indian agriculture, like the entire country, is marked by great contrasts. For example, India has more cattle than any other country in the world. Yet its people suffer from malnutrition and many are hungry to the point of starvation. One reason for this situation is the Hindu belief in the "sacred cow." Hindus constitute about 85 per cent of India's population and their religion forbids the eating of meat. Consequently, cattle are never slaughtered. Other agricultural contrasts also are evident. In India, the burden for providing foodstuffs for the people rests on the crop farmer.

Most of India's farmers live in small villages. Each cultivates three or four acres nearby which he either owns or leases. The small farm plots are really rather inefficient and unproductive. Farm practices are difficult to improve, moreover, because most Indian farmers are content with traditional methods, are illiterate, and are suspicious of change. The climate also limits the land area suitable for growing crops. Vast areas are too dry to support food crops, and other areas receive so much rain that dense vegetation covers the land. Actually, less than half of India's total area is useful for crops. Even so, improvement of crop types and farming methods could increase crop production.

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Plain. In other areas, this crop requires irrigation. Indian sugar cane yields are generally low, averaging about 3,000 pounds of raw sugar per acre. This yield is less than a quarter of Javanese and Hawaiian yields, though not far below those of Cuba and Brazil. In the 1960-61 period, ten million tons of sugar cane were produced in India. Even with this production, the crop does not add materially to the Indians' meager diet.

Rice is the principle foodgrain grown in India and is a staple in the diet of most Indians. Some thirty-four million tons of rice were produced during the period of 1960-61. This production is roughly equal to that of all other foodgrains combined. The high temperature and water requirements of paddy rice make it primarily a crop of the deltas and floodplains. Since rice is so preeminently a "wet crop," many people mistakenly believe that it is grown almost entirely by irrigation. Yet on most Indian rice farms, needed water is supplied by the rain on the fields themselves or by natural flood. This water is retained on the fields by low mud field-walls. Irrigation is necessary where the rainfall averages less than 40-45 inches per year.

Even though basic to the Indian diet, rice is low in nutritional value. In addition, it loses some food value through mechanical milling and polishing. A diet based on milled rice is culturally favored, but this rice possess little needed vitamin B. Consequently, the diet predisposes the masses to beri-beri. This is one of the most serious

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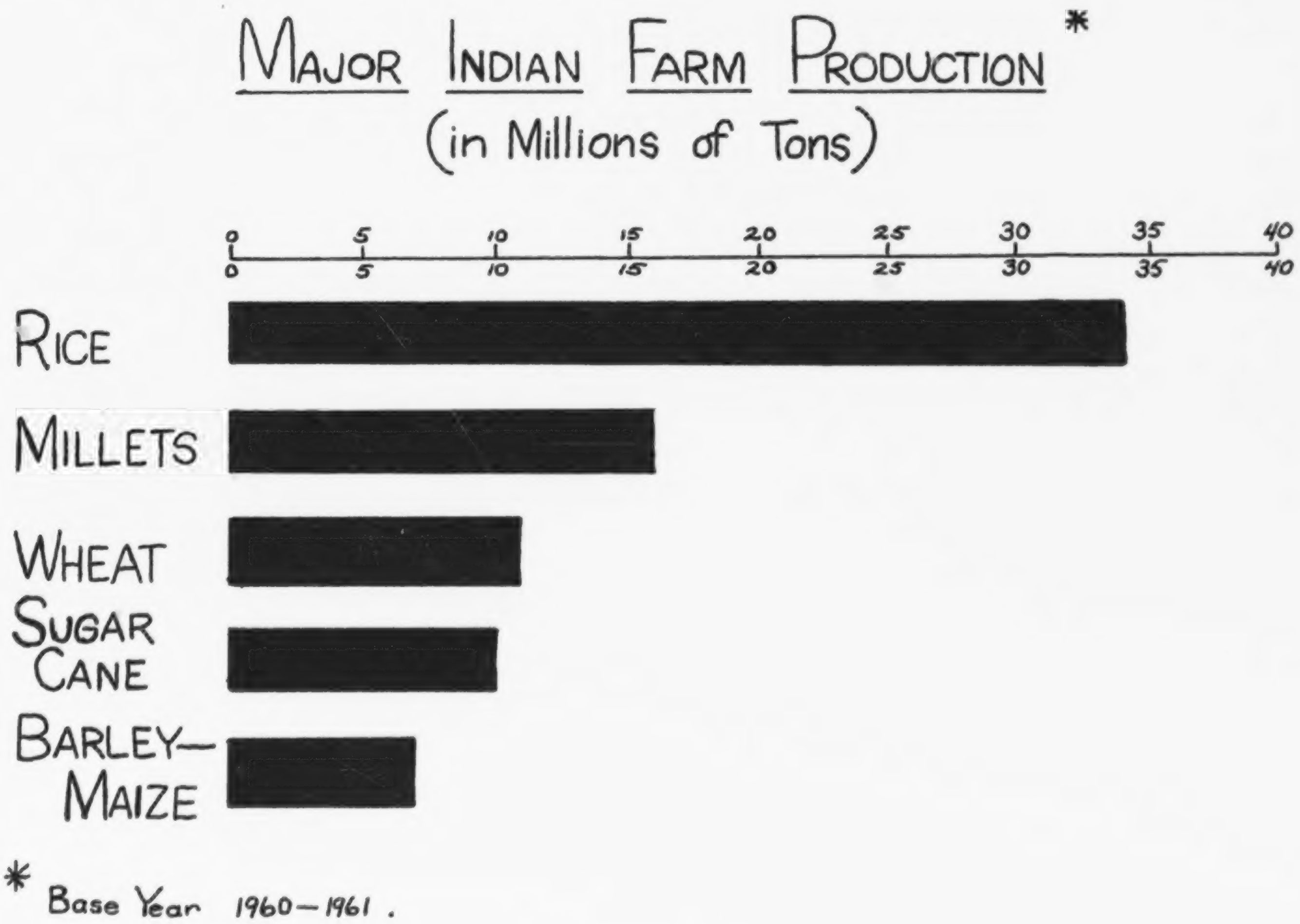
Another important foodstuff in India is wheat. Yet, only eleven million tons were produced four years ago. Wheat is grown in the dry northwest section of the country. Its greatest use is as a basic ingredient in unleavened bread.



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Other food crops are generally neglected. Lack of storage and transport facilities plus low purchasing power of the Indian masses account for this diatetically deprived situation. However, some fruits are grown, including mangoes, oranges, and bananas. Chillies (peppers) are widely produced and provide an inexpensive, often-used flavoring to the rice diet.

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the necessary equipment for large scale corn farming. Growing corn would cost more at first. So, corn, potentially valuable to Indian farm production, is not an important crop now.

India's agricultural contrasts hinder its growth toward a modern, efficient, and healthy nation. As a large cattle country, its people do not eat beef. Rice is produced in quantity, but cultural practice causes its nutritional value to be lost in milling. Large scale agricultural improvement programs meet opposition from the poverty and the attitudes of the farmers. Elimination of some of the agricultural contrasts may be a key to solving India's serious food problem.

DO NOT TURN THIS PAGE
Re-read or continue studying
these pages.

APPENDIX G

FOR RESEARCH PURPOSES ONLY

IMPORTANT

Do NOT open this booklet until directed.

Please fill in the blanks below:

Name ______________________ Age _____ Date ______________

Boy____ Girl____ Grade ______ School ______________________

Directions

In this booklet are some questions about the story you have just read. Read each question carefully and decide which response is the best answer to that question. Then, write the letter by that response in the blank beside the question number on THIS page. You will have 10 minutes to complete the questions. When you finish the questions, turn the booklet face down in the upper left-hand corner of your desk. You should then begin to work on materials you brought with you. Remember, please do not question or talk among yourselves until all booklets are collected.

ANSWER SHEET

SAMPLE:

X. Cuyahoga Falls is a city in
  A. the United States
  B. the state of Ohio
  C. Summit county
  D. all of the above.

X. ________
1. ________
2. ________
3. ________
4. ________
5. ________
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7. ________
8. ________
9. ________
10. ________
11. ________
12. ________
13. ________
14. ________
15. ________
16. ________

Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

1. Gandhi led the Salt March when the British

_____began to judge court cases without trial.
_____refused to grant India immediate dominion status.
_____refused to do away with alcoholic drink and reduce taxes.
_____refused to release many nationalist leaders from jail.

2. During 1919, one of these events did not happen:

_____Passage of Rowlatt Act.
_____Rebellion in Punjab.
_____Indians were given additional political power.
_____Gandhi was arrested for political activity.

3. India was a part of the British Empire for

_____70 years.
_____90 years.
_____30 years.
_____250 years.

4. Gandhi arrived back in India during the

_____first decade of the 20th century.
_____last decade of the 19th century.
_____second decade of the 20th century.
_____none of the above.

5. During World War II, one of these events did not happen:

_____Indian soldiers fought alongside British troops.
_____Indian political leaders did not cooperate in the war effort.
_____British promised dominion status to India.
_____British promised independence to India.

6. The Indian Mutiny occurred

_____before Gandhi returned to India.
_____with Gandhi as its leader.
_____after the Rowlatt Act was passed.
_____after World War II began.

7. Independence came to India

_____17 years after Gandhi's Salt March.
_____ 9 years after World War II began.
_____30 years after Gandhi returned to India.
_____27 years after Gandhi entered Indian politics.

8. The British majority in India's central legislature was abolished

_____as a result of the Montagu-Chelmsford report.
_____after many roundtable conferences with the British.
_____after many violent riots in the 1920's.
_____after Independence came to India.

9. India and Pakistan have been independent for

_____20 years.
_____18 years.
_____15 years.
_____none of these.

10. Civil disobedience became a weapon of the Indian nationalists

_____when Nehru was put in jail.
_____when Gandhi led the Salt March.
_____during World War II.
_____when Gandhi returned to India from South Africa.

11. Gandhi became known in both India and Britain for his work for Hindus of South Africa during the period

_____ 1900 - 1906.
_____ 1906 - 1914.
_____ 1900 - 1914.
_____ 1914 - 1919.

12. The British Labor Government helped bring Indian Independence

_____by working to ease the friction between Hindus and Muslims.
_____by announcing that India would be independent.
_____by promising dominion status for India in five years.
_____by urging Indians to fight against Nazi Germany.

13. Gandhi decided to end the "non-cooperation" movement because

_____he began roundtable discussions with the British.
_____Britain promised more Indian self-government.
_____the principles of the movement were not followed.
_____thousands of his followers were arrested.

14. Which group of events is in correct historical order?

_____India becomes a part of British Empire; Gandhi returns to India; British majority in central legislature abolished; Salt March.

_____Gandhi returns to India; Salt March; British majority in central legislature abolished; India becomes a part of British Empire.

_____India becomes a part of British Empire; British majority in central legislature abolished; Gandhi returns to India; Salt March.

_____British majority in central legislature abolished; Gandhi returns to India; Salt March; India becomes a part of British Empire.

APPENDIX H

FOR RESEARCH PURPOSES ONLY

IMPORTANT

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16. ________

Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

1. In India, the regions of heaviest rainfall are

_____the west coast and the east coast.
_____the northwestern section and west coast.
_____the central region of the country.
_____the northeastern section and west coast.

2. The change in direction of the monsoon winds is caused by

_____the seasonal differences in the heating of the land masses.
_____the seasonal differences in the heating of the water bodies.
_____the seasonal differences in the heating of the land and water masses.
_____none of the above.

3. How much rain does Bombay receive in relation to Calcutta?

_____a great deal more.
_____about the same amount.
_____slightly more.
_____a great deal less.

4. The winter monsoons

_____bring less rainfall to India than do the summer monsoons.
_____are primarily dry winds.
_____bring heavy rainfall to the southeast section. including, Madras.
_____all of the above.

5. The western slopes of the Western Ghats receive an annual rainfall of

_____more than 80 inches.
_____between 20 and 40 inches.
_____less than 20 inches.
_____between 40 and 80 inches.

6. Wheat grows well in the western part of the Ganges Valley because

_____this section receives heavy rainfall and has fertile soil.
_____this section is fairly dry and has fertile soil.
_____this area is hot and has heavy rainfall.
_____this area is cool and has fairly heavy rainfall.

7. The southeastern part of India (including Madras) receives

_____less rain than central India.
_____more rain than northwestern India.
_____more rain than the west coast.
_____more rain than northeastern India.

8. Monsoon rains fall on Bombay

_____as the winds blow southwest over the Bay of Bengal.
_____after the water-laden air passes over the Western Ghats.
_____as the winds blow northwestward from the Eastern Ghats.
_____as the water-laden air rises over the Western Ghats.

9. In which areas are irrigation projects most likely to be located?

_____central India.
_____northwest India.
_____southeast India.
_____northeast India.

10. The summer monsoon brings rain to

_____the entire Indian subcontinent.
_____a few areas of India.
_____most sections of India.
_____India's major mountainous sections.

11. Bombay and Calcutta receive their greatest rainfall

_____in the summer monsoon season.
_____in the winter monsoon season.
_____in opposite seasons from each other.
_____about the same in both seasons.

12. Whether the monsoon winds bring rain to an area is determined by

_____the season of the year and the speed of the wind.
_____the direction of the wind and land features.
_____the wind direction and amount of water in the air.
_____the speed and direction of the wind.

13. India is called a sub-continent primarily because

_____it is surrounded on 3 sides by water.
_____it has its own climatic conditions.
_____it is a very large land area.
_____none of the above.

14. In comparing the climates of Madras and New Delhi

_____Madras is slightly dryer than New Delhi.
_____Madras and New Delhi receive about the same amount of rain.
_____Madras receives more rain than New Delhi.
_____none of the above.

15. In what two sections is tea a major crop?

_____northeast and southeast.
_____northeast and southwest.
_____north central and southwest.
_____northwest and southeast.

16. If the Himalaya Mountains were removed from the area, the climate in India would

_____remain about the same.
_____be very similar to that of the rest of Asia.
_____be modified regarding temperature.
_____bring even more rain to the land.

APPENDIX I

FOR RESEARCH PURPOSES ONLY

IMPORTANT

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Boy _____ Girl _____ Grade ______ School ____________________

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Curriculum Materials Project
Bureau of Educational Research
Kent State University
Kent, Ohio

1. Of the major farm crops grown in India,

_____millet has the lowest production.
_____sugar cane has the lowest production.
_____wheat has the lowest production.
_____none of these.

2. In India,

_____more millet is grown than wheat.
_____more wheat is grown than sugar cane.
_____more rice is grown than millet.
_____all of these.

3. The two most important grain crops in India are

_____sugar cane and rice.
_____rice and millet.
_____barley and maize.
_____millet and wheat.

4. In a recent year, the Indian barley and maize crop amounted to some

_____2 million tons.
_____9 million tons.
_____7 million tons.
_____15 million tons.

5. Which of the major crops could be increased in production to provide more nutritious food for Indians?

_____sugar cane.
_____rice.
_____millet.
_____barley.

6. Much of the farm production and practices in India are determined by the

_____heavy rainfall in several large regions.
_____lack of good soil.
_____the people's ideas.
_____contrasts in seasonal temperature.

7. A recent year's wheat crop in India amounted to some

_____ 4 million tons.
_____ 6 million tons.
_____ 9 million tons.
_____11 million tons.

8. India grows about how much more rice than sugar cane?

_____twice as much.
_____three times as much.
_____less than twice as much.
_____none of the above.

9. Production of rice roughly equals the

_____production of millet and wheat combined.
_____production of sugar cane and wheat combined.
_____production of barley and maize combined.
_____none of the above.

10. Recent millet production in India was about

_____12 million tons.
_____16 million tons.
_____20 million tons.
_____19 million tons.

11. Production of corn in India

_____is very low.
_____ranks alongside barley and maize.
_____has increased more than any major crop in recent years.

12. In India,

_____wheat is grown in the northeastern section.
_____sugar cane is grown in the Ganges Valley.
_____rice is grown in the central region.
_____all of these.

13. Major Indian crops, in order of amount of production are:

_____rice, wheat, millett, barley and maize.
_____sugar cane, rice, barley and maize, millet.
_____sugar cane, rice, wheat, millet.
_____rice, millet, wheat, barley and maize.

14. In the diet of most Indians

_____rice is more important than millets.
_____corn is very important.
_____wheat is more important than millets.
_____none of the above.

15. Sugar cane production in India recently amounted to about

_____15 million tons.
_____25 million tons.
_____ 8 million tons.
_____10 million tons.

END

7-22